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At the closing date of this report the following twenty-three States and Thikanas were members of the Institute, arranged in order of joining :—

Indore	Tonk	Orchha
Dhar	Bijawar	Bharatpur.
Jaora	Barwani	Jodhpur
Datia	Bikaner	Alwar
Rutlam	Rewa	Khetri
Dewas (Senior Branch)	Jaipur	Bagli
Sitamau	Bundi	Jhabua
Narsingarh	Parlabgarh	

The financial situation having become somewhat easier in most States and the Institute's reputation having grown, it is satisfactory to record rather numerous enquiries from States which are not yet members.

On the other hand the Indian Central Cotton Committee, faced with the exhaustion of its accumulated reserves, has found itself unable to continue to sanction annual grants of Rs. 1,15,000 and the Institute's annual income from this source will now be reduced by Rs. 15,000. This serious situation can only be met by further contributions from States or by the dismissal of personnel which will reduce the output of research work.

3. *Staff and Students.*—The Director was absent on leave from March 10th, 1934, to October 18th, 1934, and the Geneticist and Botanist officiated during that period.

The post of Senior Botanical Assistant was filled, after advertising it, by the promotion of Mr. R. L. M. Ghose, M.Sc., who had been Botanical Assistant for some years.

For lack of funds a number of sanctioned posts cannot be filled.

Mr. G. G. Phadke, L.Ag., Junior Farm Assistant, remained on deputation as Agricultural Officer to Bharatpur State.

It is a pleasure to record the keenness and enthusiasm of personnel in all Sections.

4. *Visitors.*—On the 26th July, 1934, the Institute was honoured by the visit of Their Excellencies Sir George and Lady Beatrix Stanley, Viceroy and Vicereine, who spent an hour examining in detail some of the more important of the Institute's achievements and the work in progress.

Among other visitors were the following :—

Amar Singh, Kunwar of Jasol, Director of Agriculture and Grass Farms, Jodhpur State.

Anderson, Jane (Miss), Mission Hospital, Indore.

Ardeshir, Major, D. K., M.R.C.S., Mhow, C. I.

Armstrong, Dr. Allan E., Secretary, United Church of Canada Mission, Toronto, Canada.

Augier, D. E., O.B.E., Joint Opium Officer, Malwa States and Assistant Opium Agent, Neemuch, C. I.

Basu, S., Meteorologist, Poona.

Ben, Mira (Miss), Wardha.

Bhandari, K. L., Rai Bahadur, Managing Director, Nandlal Bhandari Mills, Indore.



# ANNUAL REPORT

OF THE

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24  
**INDIAN CENTRAL COTTON COMMITTEE,**  
**BOMBAY,**

FOR THE

YEAR ENDING 31st AUGUST  
1935.

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BOMBAY :

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1936.

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therefore, 191,336 acres as against 163,358 acres of last year. The Gadag Sale Society also distributed 122,497 lb. of *Gadag No. 1* seed enough for 12,250 acres outside its own area of operation. The total area under *Gadag No. 1*, therefore, came to about 102,500 acres.

With a view to spread *Jayawant* cotton in other areas, separate seed multiplication blocks of 4,594 acres at the Athani centre, 1,494 acres at Bailhongal and 445 acres at Bijapur were organised. With the funds from the Indian Central Cotton Committee, the area in the Athani centre fell on account of shortage of pedigree seed due to the damage caused to previous year's crop by very heavy floods in the Krishna river. 431,340 lb. of pedigree seed enough for 43,134 acres has been stocked for the coming season.

Both *Jayawant* and *Gadag No. 1* continued to be appreciated by the buyers who gave on an average Rs. 4 more per *Naga* of seed-cotton (1,344 lbs.) for *Jayawant*, and Rs. 12 per *Naga* for *Gadag No. 1* in auction sales.

**SIND.**—During the decade prior to the opening of the Lloyd Barrage canals, the annual area under cotton cultivation in Sind averaged slightly over 300,000 acres with an average outturn of approximately 100,000 bales. With the advent of Barrage canals, and the consequent early and assured water supply the area has increased to 703,290 acres (including Khairpur State) in the year 1934-35 with an approximate yield of 284,910 bales of cotton. The area under Sind American cotton was 193,803 acres in 1934-35 as against 146,000 acres in the preceding year. It has increased considerably during the current year 1935-36.

*Three main classes of cotton.*—Three main classes of cotton have been found to be successful in Sind, viz., (a) *Sind deshi* (b) *Sind American* (c) *Imported Egyptian*.

Among each of these three main classes the Department of Agriculture in Sind has by botanical selection, evolved improved strains, which on account of better yield, high ginning outturn or superior quality are suitable for extension in general cultivation in the different cotton growing tracts of the Barrage areas.

*Sind-American cotton.*—This cotton occupied in 1934 about 193,803 acres out of the total area of 703,290 acres under cotton and was grown mostly in Thar Parkar district. During the current year the area under *Sind-American* cotton in Nawabshah district has considerably increased. *4F* cotton was at first the most popular variety grown in Sind but is now being replaced by other types, viz. *280F*, *N.T.* and *K.T.* cottons. The improved strains now established by the Agricultural Department, seed of which is being multiplied on a large scale, are definitely superior to the parental stock and are quite distinct from the original material. These are :—

*Sind-American 4F-98.*—It has a staple length of  $\frac{7}{8}$ " to  $1\frac{1}{16}$ " and spins 34's. It has a ginning outturn of 33-34 per cent. and gives a high yield. This improved strain has been found to be the most suitable type for cultivation in the new cotton growing tracts being established on the Right Bank of the Indus.

*Sind-American 280-F1.*—This improved strain has a staple  $1\frac{1}{16}$ " long and spins 40's. It has a ginning percentage of 30 and in normal years is a very high yielder. This cotton is resistant to red leaf disease, jassid attack and can withstand seasonal variations of climate. This strain is particularly adapted for extension on the Left Bank of the Indus where the present cotton area is mostly located. This strain is the 'bread and butter' of the cotton grower in Sind in the Barrage areas and may well be termed '*Sind Sudhar*' cotton, a name recently given to it.

The high premiums in price obtained for *Sind-American* cottons during the season 1934-35 have resulted in considerable increase of area under these cottons.

*Imported Egyptian and Sea Island cottons.*—Selected strains of these cottons acclimatised in Sind have been produced by the Sind Agricultural Department, viz., (1) *Sea Island 2-4* (2) *Boss III-16* (Egyptian) have a staple length of  $1\frac{1}{4}$ " to  $1\frac{1}{2}$ " and are suitable for spinning 60-80's and (3) *Ashmouni 37* (Egyptian) has a staple length of  $1\frac{1}{8}$ " and is suitable



## APPENDIX XI.

### LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935.

#### INDIAN CENTRAL COTTON COMMITTEE OFFICE.

1. Secretary .. .. .	.. .. .	Mr. P. H. Rama Reddi, M.A., B.Sc., I.A.S...	On deputation from Madras Department of Agriculture.
2. Deputy Secretary .. .. .	.. .. .	Vacant .. .. .	—
3. Publicity Officer .. .. .	.. .. .	Mr. R. D. Mihra, M.A., Agri. (Oxon.), Post-Grad., Dip. Agri. (Oxon.), Post-Grad., Res. B. Litt. (Oxon.)	—

#### TECHNOLOGICAL LABORATORY, BOMBAY.

4. Director .. .. .	.. .. .	Dr. Nazir Ahmad, M.Sc., Ph.D. (Cantab.), F.Inst.P.	Late Head of Science Department, Islamia College, Lahore, and Assistant Director, Technological Laboratory, Matunga, Bombay.
5. Spinning Master .. .. .	.. .. .	Mr. R. P. Richardson, F.T.I. .. .. .	Demonstrator (Cotton Spinning), Technical School, Oldham.
6. Senior Research Assistant (Chemist) .. .. .	.. .. .	Mr. D. L. Sen, M.Sc., Tech. (Manch.), M.Sc. (Bom.), A.I.I.Sc., A.I.C.	Research Student at the Indian Institute of Science and Manchester College of Technology.
7. Senior Research Assistant (Physicist) .. .. .	.. .. .	Mr. N. Hari Rao, M.Sc. (Calcutta) .. .. .	Research Scholar, Technological Laboratory (Textile Physics).
8. Senior Research Assistant (Physicist) .. .. .	.. .. .	Mr. Ram Saran Koshal, M.Sc. (Punjab) .. .. .	Research Scholar, Technological Laboratory (Textile Physics).
9. Junior Research Assistant (Microscopist) .. .. .	.. .. .	Mr. Amar Nath Gulati, M.Sc. (Punjab) .. .. .	Imperial Institute of Veterinary Research, Mukteswar, U.P.
10. Junior Research Assistant .. .. .	.. .. .	Mr. C. Nanjundayya, M.Sc. (Calcutta) .. .. .	Research Scholar, Technological Laboratory (Textile Physics).

**ANNUAL REPORT**

OF THE

**INDIAN CENTRAL COTTON COMMITTEE,  
BOMBAY,**

FOR THE

YEAR ENDING 31st AUGUST  
1935.





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# Annual Report of the Indian Central Cotton Committee for the year ending 31st August 1935.

## CHAPTER I.

As a result of one of the recommendations of the Indian Cotton Committee of 1918-19, the Indian Central Cotton Committee was constituted by the Government of India in the Department of Revenue and Agriculture in their Resolution No 404-22 dated the 31st March 1935. Its functions were originally purely of an advisory character but with its incorporation in the Indian Cotton Cess Act in 1923, funds were made available "for the improvement and development of the growing, marketing and manufacture of cotton in India". The Committee's functions are thus dual in character. Firstly, it advises the Government of India and local Governments on subjects connected with the growing and marketing of cotton and brings to their notice matters which, in its opinion, require attention. Secondly, it provides funds for research into cotton problems of an all India importance or for large areas where cotton is an important crop and for the extension and marketing of improved varieties of cotton. The research section of the Committee's work has passed the experimental stage, as will be seen in *Chapters IV and V* of this report.

The Committee further offers a common meeting ground for all branches of the cotton industry and all the main interests associated with cotton *viz*, the grower, the ginner, the exporter, the millowner and the agricultural expert, are represented on it, its primary concern however, is the interest and welfare of the cotton grower.

## PERSONNEL

2. A list of members of the Committee as it stood on the 31st August 1935 is given in *Appendix I*. Under the Indian Cotton Cess Rules, members who are not *ex-officio* members, hold office for three years and one-third of their number retire each year in rotation.

At its meeting in August 1935, the Committee recorded its appreciation of the work of its President, Dewan Bahadur Sir T. Vijayaraghavacharya, K B E, on the eve of his retirement, in the following Resolution —

**"The Indian Central Cotton Committee places on record, at this the last meeting of the Committee at which Sir T. Vijayaraghavacharya presides, the uniformly, able and efficient manner in which Sir T. Vijayaraghavacharya presided over the Committee for six years. His consistent courtesy to each member and his unrivalled tact and patience in dealing with the various questions that were dealt with by the Committee have been an asset to the Committee.**

**The Committee records its best thanks to Sir T. Vijayaraghavacharya for the continued close attention he gave to details of the question disposed off during this period and it tenders him its best wishes on the eve of his retirement."**

### SUB-COMMITTEES.

3. Most of the detailed work of the Committee is carried on by means of Sub-Committees and thereby much of its time is saved at its half-yearly meetings. The Committee is greatly indebted to the members of these Sub-Committees for the invaluable assistance they have given in furthering the work of the Committee and whilst it would be invidious to single out any for special mention, it feels that it would be lacking in a sense of appreciation if it did not record its express thanks to the members of the Standing Finance and Local Sub-Committees who by reason of the nature of the work transacted by these Sub-Committees are called upon to attend meetings at much more frequent intervals than is the case with members of the other Sub-Committees.

The functions of the various Sub-Committees are detailed below and their composition as on the 31st August 1935 will be found in *Appendix II*.

(a) *The Standing Finance Sub-Committee* is a statutory Sub-Committee and is the principal executive body of the Committee. By Resolution of the Committee one of the members of this Sub-Committee must be a representative of the cotton growers. Seven meetings of the Sub-Committee were held during the year.

(b) *The Local Sub-Committee* which met seven times in the year under report deals with all matters of a general nature, not involving finance, which cannot be postponed for consideration to the half-yearly meetings of the full Committee.

(c) *The Cotton Ginning and Pressing Factories Sub-Committee* is also a statutory body appointed to deal with matters arising out of the Cotton Ginning and Pressing Factories Act of 1925. It did not meet during the year.

(d) *The Agricultural Research Sub-Committee* ordinarily assembles half-yearly during the meetings of the full Committee, reports on the progress made on schemes financed by the Committee, examines proposals for new schemes or extensions of those already in operation and considers the reports of research students.

(e) *The Technological Research Sub-Committee*, like the Agricultural Research Sub-Committee, generally meets during the half-yearly meetings of the Indian Central Cotton Committee and considers all matters connected with the Technological Laboratory and Technological Research.

(f) *The Research Students Selection Sub-Committee*, as its name implies, selects students to whom scholarships or training grants are awarded for the purpose of undergoing training in research in the several sciences pertaining to cotton. One meeting of this Sub-Committee took place during the year.

(g) *The Sub-Committee on Malpractices* was formed in order to deal with all references concerning malpractices and abuses which adversely affect Indian cotton. There were no matters during the year which necessitated a meeting of this Sub-Committee being called.

(h) *The Forecast Improvement Sub-Committee* usually meets half-yearly, its principal business being the improvement of the cotton forecasts of India.

(i) *The Special Sub-Committee on Wider Markets* which met twice during the year was appointed in August 1933 with the object of examining the question of finding wider markets for Indian cotton.

(j) *The Standards Sub-Committee* is concerned with the preparation for use in India of universal standards of certain growths of cotton dealt with in common both by the East India Cotton Association and the Karachi Cotton Association and of certain other varieties with which only the former Association is concerned. This Sub-Committee which was constituted in April 1933 met five times in the year under report.

In addition to the above Standing Sub-Committees, Special Sub-Committees are appointed from time to time to deal with specific matters which do not fall within the purview of any of the other Sub-Committees.

4. Whilst the Committee is representative of practically all sections of the cotton trade in India, it also enjoys the privilege of deputing representatives to serve on other bodies. Thus Sardar Rao Bahadur Bhimbhai Ranchodji Naik represents the Committee on the Imperial Council of Agricultural Research, and on the Board of Directors of the East India Cotton Association the Committee is represented by three members, Sardar Rao Bahadur Bhimbhai Ranchodji Naik, Mr. N. M. Deshmukh and Mian Nurullah, being its nominees in the cotton year 1934-35. On the Joint Sub-Committee of the Imperial Council of Agricultural Research and of the Committee in connection with the investigation into the cost of growing cotton, sugar-cane and their rotation crops, the Committee is represented by Sir Purshotamdas Thakurdas, Sardar Rao Bahadur Bhimbhai Ranchodji Naik, Mr. J. Vonesch, Mr. Chunilal B. Mehta, Mr. Chimanlal G. Parekh, (representative of the East India Cotton Association) and the Secretary. Its representatives on the Institute of Plant Industry, Indore, are the President, (Dewan Bahadur Sir T. Vijayaraghavacharya), Vice-President, (Sir Purshotamdas Thakurdas), Mr. Chunilal B. Mehta, Mr. Kasturbhai Lalbhai, Sardar Rao Bahadur Bhimbhai Ranchodji Naik, Mr. S. D. Saklatvala, Mr. J. Vonesch, Mr. G. C. R. Coleridge, Rao Bahadur G. R. Kothare, Mian Nurullah, Dr. W. Burns and the Secretary.

In response to an invitation from the International Federation of Master Cotton Spinners' and Manufacturers' Associations, the Committee appointed Dr. W. Burns and Mr. W. J. Jenkins, both members of the Committee, as its representatives to the International Cotton Congress which was held at Milan and Rome from the 29th April to the 4th May 1935. Only Dr. Burns, however, was able to attend.

## MEETINGS.

5. The Indian Central Cotton Committee held two meetings during the year under review, both at Bombay. The first meeting took place on the 4th and 5th February 1935, Mr. H. C. Short, Commissioner in India, Lancashire Indian Cotton Committee, attending it as a visitor.

The second meeting, which was held on the 19th and 20th August 1935, was honoured by the presence of His Excellency the Right Honourable Michael Herbert Rudolf Knatchbull, Lord Brabourne, G.C.I.E., M.C., Governor of Bombay. Amongst the other visitors present were the Hon'ble Dewan Bahadur S. T. Kambli, J.P., Minister for Education, Government of Bombay, the Hon'ble Khan Bahadur D. B. Cooper, Member for Revenue and Finance, Government of Bombay, Mr. Kasturbhai Lalbhai, Pankore's Naka, Ahmedabad, and Mr. M. D. Williams of the British Cotton Growing Association (Punjab), Ltd., Khanewal.

A list of the more important resolutions passed at these two meetings will be found in *Appendix III*.

## STAFF.

6. Mr. P. H. Rama Reddi held charge of the office of Secretary throughout the year.

The post of Deputy Secretary remained vacant.

Dr. Nazir Ahmad held the post of Director, Technological Laboratory, during the year, and Mr. R. D. Mihra that of Publicity Officer.

A temporary gazetted post of Personal Assistant to the Secretary was created for a period of one year in the first instance and Mr. C. J. Bocarro, the Office Superintendent, was appointed to it.

The office staff continued to give its loyal co-operation, and I wish to record once again my appreciation of their help during the year.

## PROVINCIAL COTTON COMMITTEES.

7. The value of provincial cotton committees in dealing with problems of provincial importance has been emphasised in previous reports and it is gratifying to note that where such provincial committees have been functioning the work done by them has been of appreciable assistance to the Committee in arriving at decisions when the subjects dealt with by them have been referred to it. The Committee is not always in a position to visualise local problems in their true perspective and therefore the discussions and decisions of provincial cotton committees go a far way towards overcoming this handicap. During the year under review, the Sind Cotton Committee met twice and the Punjab and Central Provinces Cotton Committees once each and much useful work was transacted by them. It is hoped that the current year will see a revival of the activities of the other provincial cotton committees.

## CHAPTER II.

### WORK OF THE YEAR

#### COTTON POLICY

8 THE year under review saw the completion of the Committee's investigations into the possibilities of growing long and medium staple cottons in the present short staple cotton areas of India. This investigation was the immediate result of the threatened Japanese boycott of Indian cotton in 1933 which brought home the risks India ran in producing large quantities of short staple cotton which had only a limited market. After an exhaustive survey of the prevailing conditions of each cotton tract in India, with particular reference to the quality of the cottons grown, the factors limiting the growth of superior varieties and the characteristics of the cottons considered suitable for these tracts, the Committee came to the conclusion that for the Surti, Broach, Kumpta-Dharwar, Raichur, Tinnevelles, Cambodia, Gaorani, and Central Provinces and Berar areas, and the American tracts of the Punjab and Sind, suitable long or medium staple varieties were already on hand. In the Khandesh, Salems, Westerns and Northern, Cocanadas, Hyderabad Oomras and Malvi tracts types of cotton superior to the existing inferior local mixtures have been isolated or experiments were under way with a view to evolving superior types of cotton suitable for these tracts. For the rest of the cotton growing areas of India medium or long staple cottons suitable for each tract have not yet been obtained but trials with some of the superior strains grown in other tracts with similar climatic and soil conditions may prove successful in some of them. A solution of the problem confronting the successful growing of medium and long staple cottons in the Northern and Western tract may lie in the investigation into dry cultivation whilst a study of Persian cottons might solve the problem of the Dhollerias tract. In the United Provinces the eradication of the pink boll worm seems to be the first step required to be taken before any attempt is made to improve the quality of the cotton.

#### COMPACT BLOCK OF LONG STAPLE COTTON IN SIND

9 THE Government of Bombay have, by resolution, signified their approval of the Committee's recommendation regarding the establishment of a compact block of long staple cotton, of 300,000 acres in Sind and have expressed their agreement with the conclusion arrived at by the Chief Agricultural Officer in Sind that the area south of the Jodhpur Railway is the most suitable for such a purpose. The Local Government are not, however, in favour of immediate legislation to prevent the growing of short staple cotton in the proposed block as suggested by the Committee as they consider that the end in view can be achieved by other measures such as the licensing of gins and presses, the use of special marks in licensed factories, seed supply organisation and organised

marketing. Whilst expressing its appreciation of the action taken by the Bombay Government, the Committee at its meeting held on the 19th August 1935 urged upon them the desirability of introducing such legislation as might be considered necessary to achieve the desired object if the measures contemplated by them proved inadequate, and also drew their attention to the serious danger to which the better quality cottons, capable of spinning 30's counts and over, grown in the proposed compact block were exposed by admixture not only with *Desi* but also *4-F* American cotton which is suitable for 20's counts only. To obviate this danger it has been recommended to the Local Government that the proposed compact block should be reserved for growing only the pure types of long staple cotton distributed by the Agricultural Department and that the Cotton Transport Act should be applied to it to prevent the importation of *kapas* from outside the area for purposes of mixing.

#### MORNING BROADCAST OF COTTON PRICES.

10. THE Committee made a strong representation to the Government of India to revive the system of broadcasting in the early morning the commercial news pertaining to cotton, particularly through the Bombay broadcasting station. In making this recommendation the Committee felt that the early morning broadcast of cotton prices was of considerable benefit not only to merchants and big cotton growers, some of whom had specially installed receiving sets in order to get this information, but also to the agriculturist generally who often took great pains to ascertain the latest rates coming through the radio before he sold his cotton. In some villages cut off from telegraphic communication, the villagers had even raised subscriptions for the purpose of installing receiving sets. Furthermore, by the discontinuance of the early morning broadcast of cotton news, up-country cotton markets also were greatly handicapped, as the fixing of daily prices by them depended much on the information received regarding prevailing prices in New York, Liverpool and Bombay. The matter is still under the consideration of the Government of India.

#### SPREAD OF GARROW-HILL COTTON IN THE CENTRAL PROVINCES.

11. THE rapid spread in the Central Provinces of Garrow-Hill cotton, a very inferior short staple variety so harsh as to be good only for mixing with wool, is another matter which engaged the attention of the Committee. This cotton is of late rapidly spreading and its mixing with the superior cotton of the tract has the effect of lowering the prices of the latter. The extension of this cotton is thus highly detrimental to the interests of the growers of superior cotton of the tract. The Committee therefore fully endorsed the views of the Central Provinces Provincial Cotton Committee that immediate steps should be taken by the Central Provinces Government to eradicate this cotton from the Central Provinces and Berar and that the steps proposed by them to prevent the mixing of different varieties of cotton were quite inadequate. It accordingly recommended that nothing short of a complete prohibition of the growing and handling of Garrow-Hill cotton in the Central Provinces and Berar would be effective,



## LANCASHIRE INDIAN COTTON COMMITTEE

12 In February last the Lancashire Indian Cotton Committee published its first Annual Report and in forwarding copies of it for circulation to members of the Indian Central Cotton Committee expressed the hope that the report would be found to be an acceptable effort on the part of that Committee to broaden and strengthen co-operation between India and the United Kingdom. Several members commented favourably on the report and considered it to be a valuable record of what was being done by the Lancashire Committee to popularise the use of Indian cottons in the United Kingdom. The Committee at its meeting in August 1935 passed a unanimous resolution appreciating the efforts made by the Lancashire Indian Cotton Committee to extend the use of Indian cotton in Lancashire and assuring that Committee of its desire to co-operate to the fullest extent possible in matters affecting the interests of both bodies. According to the Liverpool Cotton Association Weekly Circulars, the total takings of Indian cotton by the United Kingdom during the last three years were —

	<i>Season</i> Bales	<i>Season</i> Bales	<i>Season</i> Bales
	<u>1934-35</u>	<u>1933-34</u>	<u>1932-33</u>
Total	<u>393,784</u>	<u>361,546</u>	<u>229,740</u>

## THE COTTON TRANSPORT ACT

13 At the request of the Indian Central Cotton Committee the Government of India, in 1923, passed the Cotton Transport Act which enables local Governments to prohibit the import of cotton into any area within their jurisdiction. The Act was devised to prevent the import for mixing and substitution, of inferior cotton into areas growing superior varieties.

*Madras* — There was no change in the protected areas in the Madras Presidency.

*Bombay* — The seven protected areas notified in the Bombay Presidency remained unchanged during the year under report. The Committee approved of a proposal of the Director of Agriculture, Bombay Presidency, to fix the Mahi River as the northern boundary of the Nerbudda-Mahi protected area and the subject is under the consideration of the Local Government.

*Central Provinces* — The application of the Act was extended during the year to include the Nimar and Hoshangabad districts (excluding the Narsinghpur Sub-Division) in the protected area with a view to prevent the import of Bengals cotton into these districts for the purpose of mixing.

*Indian States* — No change was made in the protected areas in Hyderabad, Baroda, Indore, Rajpipla and Chhota Udepur States. Sangli continued with the Bombay Rules, which were introduced in the State from the 1st July 1930.

## THE COTTON GINNING AND PRESSING FACTORIES ACT.

14. Over a dozen cases of infringements of the Act were reported during the year to the authorities concerned. In some either the wrong year or indecipherable or incorrect marks were put on bales and in others, press marks were absent. In almost all cases warnings were given to the factory-owners. Where it was found that breaches were due to misunderstanding on the part of the factory-owners instructions as to the proper method of marking were issued to them and they were directed to be more careful in future. In one instance where the use of unauthorised weights was detected in a ginning and pressing factory and the only action taken was a severe warning to the factory-owner by the Collector of the District, the attention of the Local Government concerned was drawn to the leniency of the punishment and they were requested to instruct trying officers to take a serious view of such offences and to inflict adequate punishment in future.

In December 1934, the International Federation of Master Cotton Spinners' and Manufacturers' Associations, Manchester, requested the Committee to press the Government of India for the re-imposition of the rule requiring press marks to be indelibly stamped on the hoops of cotton bales, the reason stated being that the hessian covering of bales often got damaged or was cut out during sampling, thus making it impossible for the bales to be identified. The original rule requiring press marks to be stamped on the hoop was amended by the Government of India at the request of the Committee on the representation of the East India Cotton Association who drew attention to cases of hardship and losses incurred by Bombay merchants because of bales being rejected in arbitration for minor faults in marking. The method of marking prescribed in the original rule was so meticulous that the East India Cotton Association arbitrators has no option but to reject such bales as were not marked strictly in accordance with the rule, although the bales rejected were in all other respects a fair tender and even at times carried "ON" allowances. For these reasons the Committee was unable to accede to the request of the International Federation.

It is gratifying to note that on the whole the marking of bales in Indian States has proceeded satisfactorily. Legislation for this purpose and for the submission of weekly press returns is now in force in the following States :—

Alipura, Alwar, Bahawalpur, Baroda, Barwani, Bhavnagar, Bhopal, Bikaner, Bundi, Cambay, Chhota-Udepur, Cutch, Datia, Dewas (Junior), Dhar, Dhrangadhra, Faridkot, Gondal, Gwalior, Holkar State (Indore), Hyderabad (the Nizam's Dominions), Idar, Jaipur, Jamkhandi, Jaora, Jasdan, Jhabua, Jhalawar, Jind, Jodhpur, Junagadh, Katosan, Kishangarh, Kolhapur, Kotah, Lakhtar, Limbdi, Malerkotla, Manavadar, Mewar, Miraj (Senior), Morvi, Mudhol, Muli, Mysore, Nabha, Narsingarh, Nawanagar, Palitana, Patiala, Porbandar, Radhanpur, Rajkot, Rajpipla, Rutlam, Sachin, Sangli, Sardargarh, Savanur, Sayala, Shahpura, Tonk, Wadhwan, Wankaner, and Western India States Agency.

Weekly returns for cotton pressed were received from all the above States during the year, except Gwalior.

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Provinces and in Central India, reports were made to the Director of Industries Central Provinces, and the Holkar State authorities for such action as they might consider feasible. In the Central Provinces, Commissioners and Deputy Commissioners instructed their subordinates to advise cotton traders and press-owners of the evils of such practices. The Holkar State authorities propose to check the malpractices complained of by utilising the penal provisions in the Holkar State Ginning and Pressing Factories Act whenever glaring cases capable of easy proof are noticed. Under these provisions the mixing of cotton with seed or other trash can be punished with fine extending to Rs. 2,000 or even by the cancellation of licenses for working the factory. The State also propose to carry on propaganda against such practices through the medium of cotton markets.

A complaint regarding the presence of abnormal quantities of seed in cotton from the Hyderabad State was received from a Bombay exporting firm and reported to the State authorities. This led to the issue of a circular to all ginning factories by the State drawing their attention to the serious consequences which such practices were likely to have on the prices of cotton in the tracts concerned and emphasising the necessity of their discontinuance. Factory-owners were also warned that action would be taken against them involving the cancellation of the licenses if excessive seed was found in cotton ginned by them.

Reports were also received during the year that Rajputana cottons were being imported by rail into Central India and the Nimar and Hoshangabad districts of the Central Provinces for the purpose of being mixed with the superior cottons grown in these tracts. On information being sent to the Central Provinces Government, prompt action was taken to apply to the two districts concerned the provisions of the Cotton Transport Act whereby no cotton could be imported into the districts except under license. The question of moving the concerned States in Central India to introduce legislation on the lines of the Cotton Transport Act is engaging attention.

Persistent complaints regarding the presence of admixtures of seed and impurities in full pressed bales from various places in the Punjab and Patiala State has led to the suggestion being made that the Karachi Cotton Association should report the names of the presses complained against to the Association members and to this Committee. The Karachi Cotton Association has decided in the meanwhile, as an alternative, to write, on receipt of complaints, friendly letters to the factories concerned drawing their attention to the faults complained of, impressing upon them the desirability of marketing cotton pure and pointing out the embarrassment to which the factories would be exposed if the complaints were sent round to all local buyers.

#### BOMBAY COTTON CONTROL BILL.

17. The attention of the Bombay Government having been drawn by the Committee to the danger to which the high grade *1027 A.L.F.* cotton grown in the Surat protected areas was exposed by admixture for purposes of illicit

gain with a low type of cotton having high ginning percentage known as "Goghari" grown in the same area, the Local Government have decided to introduce a Bill to prohibit the cultivation, mixing or possession of this cotton in such tracts as may be notified by them. With slight modifications the Bill follows a similar piece of legislation in the Madras Presidency, which is directed against another type of inferior cotton known as "Pulichai". The Committee is convinced that unless legislation of the type contemplated is taken Goghari cotton will spread rapidly in the Surat tract and ruin the reputation of 1027 A L F cotton to the detriment of the cotton growers of the tract affected.

### COTTON MARKETS

18 The establishment of regulated cotton markets under the Bombay Cotton Markets Act has not been proceeding as rapidly as was hoped though the advantages of such markets to growers are generally recognised. So far only three markets, one each at Dhulia, Amalner and Bail Hongal, have been notified under the Act. There appears to be some demand for regulated cotton markets at Malegaon, Baramat and Dharwar and the question of opening similar markets at Surat, Broach and Bijapur is also receiving the attention of the Commissioners concerned.

District Local Boards and big *zamindars* in Sind do not appear to be aware of the advantages of regulated markets and propaganda to convince local opinion of the desirability of such markets would, therefore, seem to be necessary. It has accordingly been suggested that an experimental cotton market should be established at a suitable centre either by Government or by co-operative agency in order to educate growers and to demonstrate the detailed working of a regulated cotton market.

The Madras Government have finally published the Rules under the Madras Commercial Crops Markets Act and it will be interesting to see what measure of success attends this piece of legislation in that Presidency in so far as cotton markets are concerned compared with the Bombay Presidency and the Central Provinces.

The question of undertaking legislation for the establishment of cotton markets in the Punjab has also been engaging the attention of the Local Government and the conclusion arrived at was that the problems of marketing required much closer study before the Local Government could attempt to embark on legislation. An enquiry undertaken there revealed the existence of many evils the remedy for which, the Local Government consider, lay rather in the force of an enlightened and active public opinion than in the enactment of legislation.

It is unfortunate that owing to protests on the part of the commercial community, the Sangli State Commercial Crops Bill which was passed by the State Assembly could not be passed into law. The previous Huzur Order regulating the sale and purchase of commercial crops continues therefore to remain in force.

In the Baroda State, rules under the Baroda Agricultural Produce Markets Act to which reference was made in last year's report have not yet been finally framed.

#### UNIVERSAL STANDARDS FOR INDIAN COTTONS IN INDIA.

19. In accordance with the procedure detailed in last year's report, the Standards Sub-Committee passed the standards for the following varieties of cotton :—

<i>Bengals.</i>	<i>Oomras.</i>
<i>Sind.</i>	<i>Mathias.</i>
<i>Punjab-American.</i>	<i>Broach.</i>
<i>Sind-American.</i>	<i>Dholleras.</i>

The reference set of standard boxes intended for the Committee were, after being placed in hermetically sealed cases, sent to Bangalore for storage.

#### STANDARDISATION OF WEIGHTS IN COTTON TRANSACTIONS.

20. Last year's report contained the information that only the United Provinces and the Central Provinces Governments had accepted in full the Committee's recommendation suggesting the adoption of the railway *maund* of  $82\frac{2}{7}$  lb. and the *khandy* of 784 lb. as units of weights for cotton transactions, and that the Bombay and Punjab Governments had prescribed only the railway *maund* of  $82\frac{2}{7}$  lb. and the Madras Government the *khandy* of 784 lb. The Bombay Government were again requested to reconsider the question of standardising the Bombay *khandy* of 784 lb. but they expressed their inability to accept the Committee's recommendation owing to the divergence of views expressed by the various important commercial bodies consulted. They added, however, that the regulations in force in the Presidency did not debar cotton transactions in *khandies* of 784 lb. provided they complied with the provisions of the Bombay Weights and Measures Act by specifying in addition the exact equivalent of *khandies* in one or other of the standard weights, *viz.*, lb., quarters, cwts., etc.

Of the five principal cotton growing States addressed in this matter, Gwalior has adopted the *maund* of  $82\frac{2}{7}$  lb. and the *khandy* of 784 lb. and Baroda the *maund* of  $82\frac{2}{7}$  lb. In Indore the *maund* of  $82\frac{2}{7}$  lb. is the standard and legal weight, all other weights being unauthorised. The Hyderabad and Mysore States are still considering the question.

#### REPRESENTATION ON THE INTERNATIONAL FEDERATION OF MASTER COTTON SPINNERS' AND MANUFACTURERS' ASSOCIATIONS.

21. In order to deal more effectively with complaints arising abroad regarding faults, often of a minor nature, in Indian cotton which frequently received wide publicity through the publication of the proceedings of the bodies at which they were discussed, the Committee considered it desirable to obtain,

if possible, representation on the International Federation of Master Cotton Spinners' and Manufacturers' Associations, Manchester. It is understood however, that under the Federation's constitution, the Committee is not entitled to ordinary membership and an application has accordingly been made for admission as an Associate Member. The result\* is awaited.

### MEANS TO PREVENT THE INTRODUCTION OF FOREIGN COTTON PESTS

22 *The Mexican Boll weevil (Anthonomus grandis)*—The restrictions imposed by the Government of India in 1925 on the import of American cotton into India continued in force, without change, during the year under review. American cotton can be imported into India only through the port of Bombay and that, too, only after fumigation with hydrocyanic acid gas. Imports of American cotton rose to 63 171 bales during the season as against 22,499 bales in the previous year. A rebate of fumigation fees at the rate of 8 annas per square bale and 5 annas per round bale on all American cotton fumigated during the year ending 31st March 1934 was sanctioned by the Government of India and paid to importers in April and May 1935.

23 *The Red (Sudan) Boll worm (Diparopsis castanea) and other pests*—The restrictions placed on the import of foreign cotton seed under Government of India Notification No. 1213 Agri, dated the 27th May 1930, in the Department of Education, Health and Lands, and the entire prohibition of the import of foreign *kapas* (unginned cotton) under Government of India Notification No. 897 Agri, dated the 24th July 1925 remained in force throughout the year. Under these regulations two parcels of cotton seed were received for examination and fumigation during the year.

### COLLECTION AND SUPPLY OF INFORMATION

24 As in the past, notes† on the progress made in the Provinces and Indian States in the introduction of improved varieties of cotton and on the work of the Committee were contributed to the Bombay Cotton Annual published by the East India Cotton Association.

### PUBLICITY AND PROPAGANDA

25 A full account of the activities of the Publicity and Propaganda Department of the Committee will be found in the Annual Report of the Publicity Officer which forms *Chapter VII* of this Report.

The most important event of the year was the campaign conducted by the Publicity Officer for the extension of control measures against the pink boll-worm in the United Provinces. This campaign had for its object the focussing of public attention on the necessity of tackling the pink boll-worm evil and the advantages to be derived from its control. At the same time an enquiry was carried out in connection with the question of levying a cess to meet the cost

\* Information has since been received that the Committee has been admitted to Associate Membership.

† Appendix V

of the required heating machines, their installation, working expenses, etc., should it be decided to introduce control measures. A specially designed 10-colour poster was used with much advantage during the campaign.

Seven press communiqués were issued, four of which dealt with the development of cotton growing in Sind, the Bombay Presidency, the Central Provinces and the Coimbatore District of the Madras Presidency.

In addition to the issue of special articles and pamphlets from time to time, the Department participated in the exhibitions at Nanded organised by the Agricultural Department of Hyderabad State, the All-India Exhibition, Lahore, and the Kolhapur Fair. Publicity and Propaganda material for use at the Memorial Exhibition at Formosa (Japan) was also supplied at the request of the Agent, the Japan Cotton Spinners' Association, Bombay.

### PUBLICATIONS.

26. The Committee receives partly on an exchange basis and partly by subscription a number of important scientific and technical journals which are circulated to research workers and institutions of the Committee. This arrangement is not only more economical in as much as it obviates the duplication of journals and periodicals purchased out of the Committee's funds for the various schemes but at the same time affords all workers an opportunity of perusing varied and up to date scientific literature, which might not otherwise be available to them.

The name of the Committee is on the free mailing list of a number of private and public institutions to whom the thanks of the Committee are due. Particular mention should be made of the British Cotton Industry Research Association for its Summary of Current Literature and the Shirley Institute Memoirs, the Empire Cotton Growing Corporation, the British Cotton Growing Association, the East India Cotton Association and the Karachi Cotton Association for the supply of their publications for distribution to members. The Committee further records its thanks to the Indian Trade Commissioner, London, the U.S.A. Department of Agriculture, the Egyptian Ministry of Agriculture, Technical and Scientific Service, the Liverpool Cotton Association, the Lancashire Indian Cotton Committee, the Imperial Bureau of Plant Genetics, Cambridge, the Textile Institute, Manchester, the Imperial Institute, London, the Indian Statistical Institute, Calcutta, the National Institute of Sciences, Calcutta, the Academy of Science and other Associations and Chambers of Commerce which supply it with reports, statistics and other literature from time to time. The Committee is also on the free exchange list of the Imperial Council of Agricultural Research, the Imperial Institute of Agricultural Research, Pusa, and the Director-General of Commercial Intelligence and Statistics, Calcutta.

### SECRETARY'S TOURS.

27. During the year under review the Secretary visited Simla, Indore (twice), Lyallpur, Lahore, Madras, Coimbatore, Perindurai, Bangalore, Irwin Canal Farm, and Hyderabad in connection with the work of the Committee.



## FINANCIAL.

28 In *Appendix VI* will be found a statement showing the Receipts and Expenditure of the Committee and also the Balance Sheet for the year ending 31st March 1935 Receipts amounted to Rs 8,73,983 and expenditure to Rs 9,71,623 The estimated expenditure for the year was Rs 13,57,585, the principal items of savings being under the following heads —

Administration (Rs 28 063), Improvement of Cotton Marketing (Rs 12,584), Seed Distribution and Extension Schemes (Rs 1,06,575—three schemes sanctioned were held in abeyance), Printing and Propaganda (Rs 11,046), Technological Research (Rs 83 540), Surat Boll-worm Clean up Scheme (Rs 7,960), Broach Cotton Breeding (Rs 4,716), Defibration of cotton seed, Bombay Presidency (Rs 2,000), Madras Pempheres and Physiological (Rs 21,626), Punjab Botanical (Rs 32,509), Punjab Entomological (Rs 8,910), Punjab White Fly (Rs 3,170), Punjab Physiological (Rs 15 264), Punjab Spraying Trials (Rs 2,736), Central Provinces Botanical (Rs 2 836), Sind Physiological (Rs 5,705), Hyderabad Botanical (Rs 1 185) Hyderabad Pink and Spotted Boll worm (Rs 4,135), Bikaner Gang Canal (Rs 4 527), Baroda Root Rot (Rs 2,557) and Bengal Comilla (Rs 2,196)

At the suggestion of the Government of India that the Committee should consider the desirability of maintaining a minimum balance from its accumulated funds, it was decided to fix the minimum balance at Rs 9 lakhs subject to the condition that there should be no objection to drawing on this balance in case of emergency, provided that such shortages are made good as soon as conditions improve

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## CHAPTER III.

### STATISTICS.

29. FROM its very inception fourteen years ago the Committee has evinced considerable interest in the subject of cotton statistics and this interest has been shown not only in the direction of attempting to improve as far as possible, the accuracy and form of presentation of the statistics previously available, but also in that of introducing new statistics for various phases of the cotton industry information about which was lacking. In the following paragraphs the further progress registered, or work done during the year under review alone is recorded, as space does not permit the recapitulation of past history.

30. *Cotton Crop Estimates.*—The arrangement under which the Director-General of Commercial Intelligence and Statistics, Calcutta, telegraphs cotton crop estimates to the Secretary, Indian Central Cotton Committee, for their simultaneous release at Bombay and Calcutta, worked satisfactorily during the year under report.

These estimates showed a fall in the area of cotton in India from 24,136,000 acres in 1933-34 to 23,830,000 acres in 1934-35. The decrease was due to the unfavourable weather conditions prevailing at sowing time in Hyderabad State, which alone registered a fall in area of over half a million acres. The total estimated yield for the season was 4,807,000 bales of 400 lb. as compared with 5,068,000 bales of 400 lb. during the preceding season, and the average yield per acre was 81 lb. as against 84 lb. in 1933-34. Unfavourable weather conditions, especially the cold spell and frost in January reduced the yield of the crop.

An interesting point is brought out in the area figures for each variety of cotton reported during the last five seasons. Though it cannot be said that there has been any steady decline or increase in area in the case of all other varieties for which separate figures are reported, it is noteworthy that the area under Cambodia has steadily risen from 2.5 lakh acres in 1930-31 to the record figure of 5 lakh acres in the last season. *Cambodia* is, like *Surat-Navsari*, *Kumpta* and *Hyderabad Gaorani*, one of the very best cottons of the peninsula, almost wholly consumed in India and rarely exported.

31. The piece-meal publication of Provincial and State cotton forecasts had been a source of misunderstanding to the Trade, especially in the forecasted yield of crops like Broach, the estimates for which are contained partly in the Bombay forecasts and partly in the Baroda forecasts. The recent decision of the Government of India to withhold the publication of the individual forecasts until after the publication of the all-India forecasts, is therefore a welcome feature. The revival from August 1935 of the system of publishing all-India forecasts in leaflet form is also a great convenience to the Trade, as it dispenses with the necessity of purchasing copies of the more costly Indian Trade Journal for the sake of forecasts.

32 The scheme for the improvement of the cotton crop forecasts of the Bombay Presidency, sanctioned by the Committee in January 1934 for a period of two years in the first instance at an estimated total cost of Rs 11,694, completed its first year on the 15th June 1935. The investigations brought to light several sources of error in the compilation of Bombay cotton forecasts. It is particularly noteworthy that a very serious mistake, which regularly swelled the estimated yield of an Indian State by a lakh of bales was discovered and rectified during the year. In addition, the district standard yield figures which, for want of crop-cutting experiments, had not been revised for many years were examined in the light of other available statistics, and tentative revised yield figures adopted for West and East Khandesh districts, and Belgaum, Bijapur and Dharwar districts. Further work is in progress. In the meantime, in view of the importance of the question of improving the accuracy of cotton forecasts, the Committee decided that the First Progress Report of the scheme should be brought to the notice of the Government of India.

33 Reference was made in last year's report to the efforts made by the Committee to obtain by local enquiries reliable estimates for the quantity of raw cotton annually used in India for such domestic purposes as hand spinning and the making of quilts, mattresses, cordage, etc. The respective reports, except Hyderabad, submitted on the completion of these enquiries, were examined by the Cotton Forecast Improvement Sub Committee at its meeting held in August 1935. As the enquiry made in Bengal had failed to furnish the data necessary to arrive at a standard for village consumption in the non cotton growing tracts of Bengal and Bihar, the Committee deemed it advisable to conduct another enquiry in Bihar and sanctioned a sum of Rs 1,200 for this purpose.

34 It is highly gratifying to note that on the whole the subject of the improvement of the accuracy of Government cotton forecasts is receiving increasing attention at the hands of the authorities concerned, to whom an opportunity of meeting and discussing their problems is afforded by the half-yearly meetings of the Cotton Forecast Improvement Sub Committee. As the result of an investigation into the repeated under-estimation of the Sind crop, the standard yield figures of Sind have been revised tentatively. Similar action taken with regard to certain districts in the Bombay Presidency proper has already been referred to. In British Punjab, crop cutting experiments are under way on a more extensive scale than before. Failing to get from the Punjab States an adequate response to the suggestion made to them for revising their estimates of yield, it has been decided to make use of the figures for cotton pressed for the purpose of estimating the crop of such States. The Central Provinces and Berar have advanced a step further in the collection of complete and reliable statistics to check the accuracy of their forecasts. Arrangements have been made from the commencement of the season 1935-36 to obtain from factories a weekly statement showing the quantity of cotton ginned together with information regarding its origin. Likewise monthly returns have now been arranged for, from every custom station on the borders of Hyderabad State, with a view to finding out the

quantities of *hapas*, unpressed cotton, and pressed cotton, that are exported from each district in the State to each of the adjoining British districts. The question of the revision of the standard yield figures of Mysore State is also being examined by the Revenue Commissioner of the State.

35. As in the previous year, a report on the estimated production, during the season, of Indian cotton of different staples, was issued in May. With the ungrudging co-operation of the Agricultural Departments it was possible to give in this report more detailed information than had been possible before. Not only were the chief fibre characteristics of the different growths given but also the civil districts in which they were grown were specified. The criticisms received on this report show that the attempt is being appreciated by the trade and industry though the report is likely to be more useful to them by the introduction of a few more innovations in it. One suggestion received and already accepted by the Committee is that trade estimates of the crop should be given side by side with the Government estimates and an attempt will be made to give effect to this suggestion in the report to be published in May 1936, although owing to the dissimilar bases on which the two estimates are prepared the likelihood of reconciliation would appear to be somewhat remote.

36. *Press Statistics*.—Ever since the passing of the Cotton Ginning and Pressing Factories Act in 1925, all cotton presses in British India have been furnishing weekly returns of cotton pressed in them and these have been duly collated by provincial authorities and forwarded to the Director-General of Commercial Intelligence and Statistics for publication. It was soon realised, however, that unless similar statistics were obtained from Indian States it would be impossible to arrive at any correct estimate of the cotton crop of India and accordingly efforts were made early to enlist the co-operation of Indian States. The problem presented considerable difficulties as no less than sixty-five States had to be individually approached for necessary legislation providing, *inter alia*, for the establishment of press statistics. The Committee is gratified to be able to report now that its efforts have not been in vain and that all States addressed have fallen into line with British India in this matter, the last of them—Gwalior—having signified its intention of compiling press returns from the current season.

The returns of cotton pressed during the season 1934-35 show that 3,444,781 bales were pressed in British India and 1,169,820 bales in Indian States, making a total of 4,614,601 bales for the whole of India, the corresponding figures for the preceding season being 4,045,516 bales, 1,286,317 bales and 5,331,833 bales respectively.

37. *Loose (unpressed) Cotton Statistics*.—Unlike the U.S.A. cotton ginnings are not reported in India, and the lack of this information leaves a big gap in the statistical information on the Indian cotton crop. This gap can, however, only be bridged if the press statistics referred to in the preceding paragraph are supplemented with information regarding the quantities of loose cotton (ginned but unpressed) taken directly into mills or used for

domestic consumption or for exports. In 1925, the Committee therefore brought to the notice of provincial authorities in the Punjab, the United Provinces, the Central Provinces and Berar, and Bombay the desirability of collecting these statistics from mills on a voluntary basis. They readily agreed and the figures relating to loose cotton received at mills in the major cotton growing provinces of British India are being compiled and published since 1926 (*vide Appendix VII*). It will be seen from these figures that mills situated in cotton growing tracts take considerable quantities of raw cotton in loose unpressed form.

In view, however, of the fact that the information now available is not complete even for the provinces for which they are collected, the Committee at its meeting held in August 1935 decided to recommend to the Government of India to amend the Rules under the Indian Cotton Cess Act by providing for the desired information to be shown in the monthly returns furnished by mills under the Act. Should the proposal be accepted, it is hoped that, with the co-operation of Indian States, the necessary figures would, before long, be available for the whole of India.

38. *Consumption*.—The compilation and publication of the monthly statements\* (1) of Indian cotton consumed in British Indian mills, (2) of Indian cotton consumed in mills in Indian States, and (3) a consolidated statement of (1) and (2) specially meant for publication in the daily Press were continued. For the first time in the history of the Indian mill industry, the consumption of Indian cotton in India exceeded the limit of 2½ million bales and registered the record consumption of 2,612,132 bales against the previous record of 2,373,094 bales in 1929-30. Much of this rise is due to the substantial recovery of Bombay Island which is by far the largest consuming centre of Indian cotton.

The world's total consumption of Indian cotton, too, increased from 4,772,000 bales in the previous year to 5,599,000 bales in the year ending 31st July 1935.

39. *Exports*.—The exports of Indian cotton during the season 1934-35 were 3,115,420 bales of 400 lb. as compared with 3,269,000 bales in the previous year.

40. *Stocks*.—Accurate and reliable information regarding the stocks of raw cotton left in the country at the end of each season is as important to the cotton trade as it is to those on whom falls the task of checking forecasted production of raw cotton with the actuals accounted for at the close of the season. Except for the stocks held by the trade and the mills in Bombay this information had been lacking till 1933, when the Committee took this matter up and set to work to enlist the co-operation of various trade bodies, mills and cotton market committees in collecting the desired information. In the short period that has elapsed since this question was first taken up, a considerable

part of the field has been covered, and it is hoped that, with an increasing appreciation of the usefulness of these statistics they will in due course be made more reliable and complete.

The information collected with regard to the stocks held on the 31st August 1935 is contained in *Appendix VIII*.

It may be mentioned here that for the very late crops, *viz.*, Salems, Cambodias and Tinnevellies of the Madras Presidency, the season for which is taken to be the year ending 31st January, the Director of Agriculture, Madras, has made arrangements to collect every year the stocks held on the 31st January, by the trade in their respective tracts, and by mills in the whole of the Presidency. The first set of figures collected under this arrangement is given in *Appendix VIII*.

41. *Demand for various types of Indian cotton.*—Another useful line of enquiry undertaken by the Committee is the Indian mill and export demand for the various types of Indian cotton. In the changing conditions of the world, the importance of obtaining a clear idea of the nature and extent of the demand for each type of cotton, and of the variations in this demand from year to year cannot be overemphasised.

The Statistical Leaflets Nos. 3 and 4 (second issues) giving the results of the inquiry into exports and receipts at mills in 1934-35 are reproduced in *Appendices IX and X*.

41A. *Publications.*—The following publications were issued during the year under report :—

- (1) *Statistical Leaflet No. 1 (Second Issue)*—"Report on the Staple Length of the Indian Cotton Crop of 1934-35 Season".
- (2) *Statistical Leaflet No. 2*—"Stocks of Indian Raw Cotton held in India by the Mills and the Trade on 31st August 1934".
- (3) *Statistical Leaflet No. 3*—"Receipts at Mills in India of Raw Cotton classified by Varieties—1933-34 Season".
- (4) *Statistical Leaflet No. 4*—"Exports by Sea of Indian Raw Cotton classified by Varieties—1933-34 Season".
- (5) *Statistical Bulletin No. 4*—"Supply and Distribution of the Various Types of Indian cotton during the season of 1933-34".

The last publication is an attempt, the first of its kind ever made to examine the supply and distribution of the various types of Indian cotton from the material provided by the first named four publications. Thanks are due to the Vice-President, Sir Purshotamdas Thakurdas, who kindly examined the draft of this bulletin and contributed a foreword to it.

## CHAPTER IV.

### RESEARCH.

42. WITH the passing of the Cotton Cess Act in 1923, the Indian Central Cotton Committee was provided with funds for "the improvement and development of the growing, marketing and manufacture of cotton in India." The Committee carries out these objects by the establishment and direct control of the Technological Laboratory at Matunga, Bombay, and by offering subsidies to Departments of Agriculture and Co-operative Sale Societies in provinces and States for the investigation of some specific problems of economic importance and for the extension and marketing of improved types of cotton produced either by Departments of Agriculture or by the research financed by the Committee. In addition the Committee contributes annually a large sum of money to the Institute of Plant Industry, Indore, which is a central research station for cotton in the black cotton soils of Central India. The problems dealt with in provinces and States include many research schemes of more than local importance, viz., botanical for obtaining improved types of cotton by selection and hybridisation, physiological for the investigation of crop growth, bud and boll shedding and periodic failure of American cotton in the Punjab, mycological to provide measures against wilt and root rot and entomological for the study of the life history of cotton pests and measures to eradicate them. The Committee has also undertaken jointly with the Imperial Council of Agricultural Research the economic enquiry into the cost of the cultivation of cotton, sugar-cane and their rotation crops in the principal cotton and sugar-cane growing areas of India. All research and seed extension and marketing schemes are, as they are received from the Directors of Agricultural Departments, first examined and approved by the Agricultural Research Sub-Committee before they are finally sanctioned by the Committee which keeps itself in close touch with the progress of their work by means of annual reports submitted by officers in charge. Technological problems are similarly dealt with by the Technological Research Sub-Committee before they are approved by the Committee. The Committee provided funds during the year ending with the 31st March 1935, amounting to Rs. 6,44,006 for research and seed distribution and marketing schemes in addition to the sum of Rs. 4,92,328 sanctioned to the Technological Laboratory, Matunga, the Institute of Plant Industry, Indore, and the economic enquiry into the cost of the cultivation of cotton, sugar-cane and their rotation crops. The Committee also offers scholarships and training grants for post-graduate training in India and abroad in subjects pertaining to cotton industry.

### TECHNOLOGICAL LABORATORY.

43. The Annual Report of the Director, Technological Laboratory, forms Chapter VI of this report and it may be referred to for details. The work of the Laboratory, particularly of the spinning and yarn testing sections,

suffered to some extent during the year owing to the necessity of slowing down the processing of samples for over six weeks in order to allow the extensions to the spinning and yarn testing block and the replacement of some of the old blow-room machines with new up-to-date machines. This accounts for the decline in the number of samples and lots spun during the year as compared with last year. The samples tested during the year fell, as usual, under four classes, *viz.*, (a) agricultural samples, (b) samples of standard Indian cottons, (c) Trade samples and (d) Technological samples. The agricultural samples represent mostly new strains which are still in experimental stage and some old types grown in connection with certain field experiments undertaken by agricultural officers in provinces and States. Of these experiments special mention might be made of the tests on 38F, 43F, *Boss III* and *Sea Island* cottons and on the effect of differential irrigation upon the fibre properties and spinning quality of cotton. The standard cottons consist of certain improved varieties which are now being grown on 15 per cent. of the total area under cotton cultivation in India. They include *Umri Bani*, *Verum 262* (Nagpur), *Verum 262* (Akola), *Punjab-American 289F*, *Punjab-American 4F*, *Jayawant* (Kumpta), *Surat 1027 A.L.F.*, *Gadag 1* (Dharwar-American), *Cambodia Co. 2*, *Sind Sudhar*, *Sind N. R.*, *V. 434*, and *Late Verum*, and the results of the first nine types were published during the year in four-page circulars. The trade samples represent (a) the main types of commercial cotton which form the bulk of the Indian cotton crop and (b) the first arrivals of the new crop of cotton of a season. The object of these tests is to supply first hand information to the trade and mill industry regarding the waste losses and the spinning quality of these cottons. During the year under report 25 samples for the trade and 20 samples for the industry were tested and the results were published in 2-3 page circulars as usual. In addition to these tests the Laboratory undertakes on payment of certain fees laid down by the Committee tests on samples supplied by individual mills and firms in their private capacity and 39 such samples were received and reported upon during the year. The experiment started during the last year at the instance of the trade for finding out the effect of artificial watering on the spinning quality of Amraoti and Broach cottons was continued. The tests on Amraoti cotton were completed during the year and those on Broach cotton are in progress. With regard to the investigation into the effect of different degrees of compression on the spinning quality of long staple cotton, bales pressed to the same size but weighing approximately 400 lb., 300 lb. and 200 lb. of 289F, 1027 A.L.F., *Jayawant* and *Cambodia* have been purchased and the necessary tests will be commenced in due course. The enquiry into the effect of storage of cottons in open plinths and in sheds at Karachi was completed and the results show that cotton stored in the open definitely suffered both in grade and spinning quality. The technological samples comprise the samples spun in connection with certain research problems. The problems undertaken during the year include the limit spinning tests, high draft tests, effect of balanced and unbalanced drafts on mixings, effects of storage on seed cotton prior to ginning, combing of good quality Indian cottons and comparative tests on the effect of change in the blow-room machinery.



The moisture testing section continued the tests on the moisture content of Indian cotton received in Bombay and in view of the adequate data obtained on these tests during the past three years a final report containing all the results was written up and submitted to the East India Cotton Association

## INSTITUTE OF PLANT INDUSTRY, INDORE

44 The Annual Report for 1934-35 of the Director, Institute of Plant Industry, Indore, will be found in *Appendix IV* which may be referred to for the details of work carried out during the year. The institute was opened in 1924 with a view to providing a central research station for cotton in the black soils area of Malwa plateau and it is maintained by grants contributed by the Indian Central Cotton Committee and some of the States in Central India and Rajputana. The programme of the Institute includes the general botany, physiology and genetics of cotton in addition to a number of agricultural investigations relating to the cultivation of cotton and other crops. As decided last year, a beginning was made for the general distribution of the two new types of *desi* cotton, *Malvi 1* and *Malvi 9*, which have been found to yield 20 per cent more than the local mixture. *Malvi 9*, the better of the two, is superior to local by 4 to 6 per cent in ginning and about 40 per cent in spinning. It has also been discovered in the course of the study of genetic variance in cottons that further improvement is possible in both *Malvi 1* and *Malvi 9* and that the latter is capable of greater improvement. *Cambodia* as compared with *desi* has been found a poor yielder on all soils in Central India with the possible exception of a few areas under tank irrigation and it does not therefore appear to have any future in Malwa unless it fetches a premium of 50 per cent. Experiments have been laid out for definitely ascertaining whether *Upland* American can hold its own against *Desi* in Malwa and, if so, by what means. The data obtained from the botanical survey of cottons in Malwa and Nimar reveal very interesting and important differences in survival value of different types and physiological work is being undertaken to find out the causes of the differences in plant response. The study of hybrids between *G. Africanum* and cultivated Asiatic cottons has shown that the normal chromosome complement of all plants so far studied is 26 but a few plants contain small 'islands' of tetraploid tissue. Root studies on wilt have confirmed the indications obtained last year that the presence of fungus need not necessarily lead to death or even to wilting and that on the other hand wilting followed by death might occur even when no fungus could be found. The moisture contents of the soil around wilted plants, particularly in the first one foot below the surface, have been found higher than around healthy plants. This is evidently due to the change in the physical condition of soil brought about by affected plants and the influence of this change on the aeration and activity of roots is obvious. The application of organic and inorganic manures and the dressings of substances calculated to improve the physical texture of soil have given different degrees of virulence, nitrogen and phosphate seem to encourage wilt very considerably.

## GRANTS-IN-AID.

## SCHEMES IN PROGRESS IN PROVINCES AND STATES.

## MADRAS PRESIDENCY.

45. *The Herbaceum Scheme* was first started in 1923 with the object of securing from local *Uppam* (*G. herbaceum*) suitable types equal to *Karunganni* (*G. indicum*) in yield and spinning quality when grown under usual rain-fed conditions in Salem and Coimbatore districts where rainfall is low and often precarious. In years of good rainfall *Karunganni* gives a much higher yield than *Uppam* while in bad years the position is reversed, *Uppam* being a hardier variety, capable of giving a fair yield even in adverse seasons. The cultivator meets the situation by growing a mixture of the two varieties. The *Karunganni* strains which are being distributed by the Agricultural Department are capable of spinning up to 26's warp counts against about 14's of *Uppam*. It was, however, realised after seven years' hard work that the chances of obtaining pure strains from *Uppam* that could spin above 20's were few and it was therefore decided in 1930 to secure by hybridisation what was found impracticable by pure line selection. The new line of work has now given some valuable results which are likely to prove to be of considerable economic importance. Two of the selections, *viz.*, 4714 and 4801, from a cross between *indicum*, *cernuum* and *obtusifolium* have not only proved to be pure for seed and lint characters but have given in comparative tests much better yields than all other strains with which they were compared. Selection 4714, the better of the two, has given an increase of 75 per cent. over the control, *Karunganni* 2622, and has also beaten by 20 per cent. *Karunganni* 546 which has been leading in yield ever since its inclusion in comparative tests. It seems also to possess drought resistance comparable with *Uppam*. It has a lint length of 26 mm. and ginning outturn of 29 per cent. and its spinning value has been estimated at 28's. This selection might be said to have fulfilled the object, provided it behaves in years of good rains in the same way as it did this year of insufficient rainfall. A few inter-varietal and inter-specific crosses have been back-crossed to both the parental types with a view to exploit the new technique of back-crossing. Some of the plants grown of X-rayed *Uppam* seed have developed some interesting peculiarities which will be studied next year.

46. *Pempheres and Physiological Scheme*.—The main object of this scheme when it was sanctioned in 1925 was (a) to devise measures for the control of the cotton borer (*Pempheres affinis*), (b) to investigate bio-chemically the causes of the susceptibility of cotton plants to this insect and (c) to continue the work on bud and boll shedding which had already been started by the Cotton Specialist at Coimbatore. But due to the difficulty of securing the services of a competent plant physiologist the scheme had to be held in abeyance till 1930 when it was decided that two officers from the Madras Agricultural Department should be sent to England for special training in plant physiology and bio-chemistry in order that they might, on their return after training, occupy the posts of Physiological Botanist and Bio-Chemist under the scheme and that pending their return a beginning might be made with the preliminary

work under the supervision of the Cotton Specialist. The scheme commenced formally in September 1931 when Messrs T R Narayana Iyer and S Kasinatha Iyer were sent for training in plant physiology and bio chemistry respectively. On their return after training the scheme was reviewed in February 1935 when it was decided to restrict its scope to the reduction of the shedding of flowers, buds and bolls in *Karunganni* caused by untimely rains by breeding and physiological methods and devising control measures against the cotton stem borer. From the investigations carried out in 1933-34 it was noticed that the actual loss due to pemphres was only 4 per cent,\* but the results obtained from the repetition of the same experiment during the year under report show that assuming the incidence of attack as 100 per cent, the loss sustained in yield amounts to nearly 50 per cent — 20 per cent due to the death and the rest to the poor yield of affected plants. The eight American varieties, *Gadag*, *Bourbon*, *Co 2*, *Buganda*, *9355*, *Durango*, *Buri* and *U 4* which were tested during the year were found equally susceptible to the attack though they slightly differed in their resistance. A few crosses between *Co 2* and some South American types which were found resistant to the attack have been re crossed with *Co 2* with a view to obtaining resistant types. On bio chemical side the regeneration of the tissue of the affected plant is confined only to a third of the larval gallery and is not begun till the pest is at least a fortnight old. It is, however, interesting to note that Peruvian cotton gums up so rapidly after the attack that insect responsible for the damage die out quickly. Three parasites a Braconoid and two kinds of Chalcids were observed attacking the borer in its grub stage but their damage did not exceed 1 per cent. The incidence of the pest was found considerably low in localities where the close period of cotton is longer than three months and also when sowings were put off by about three weeks in September the crop was free from the pest till January showing thereby that the pest could be easily brought under control if no cotton plants are left in fields for over three months between the harvest of the old crop and the sowing of the next crop of cotton. The preliminary investigations into the shedding of flowers, buds and bolls indicate that boll retention is higher in *Karunganni* types than in *Uppam* and that cotton when mixed with black gram has less shedding than when it was sown pure.

47. *The Fodder Cholam Scheme* commenced in January 1931 with a view to ascertain the causes of the harmful effects of *cholam* (*Andropogon sorghum*) as compared with *Cumbu* (*Pennisetum typhordeum*) on the succeeding crop of cotton in the Tinnevely district and to find out suitable remedial measures. The work of the year under report was more or less a repetition of what had been done in previous years except that two new experiments were added for the study of base exchange in soils and the effects of the application of compost and that a few experiments which had given definite results were omitted. The weather conditions were unfortunately so abnormal that with the exception of the one experiment on base exchange no other experiment gave any decisive result though the general trend was in the direction already indicated in previous years. The study of base exchange shows that while there is little difference between *Cholam* and *Cumbu* soils in the first layer

of six inches, the second and third six inch layers of *cholan* soils contain a much greater amount of sodium ion and a little less of magnesium than in the corresponding layers of *Cumbu* soils. This difference is probably responsible for the deflocculated condition and reduced permeability of *cholan* soils as already noticed, and a knowledge of the processes which bring out this change may prove very helpful in devising suitable ameliorative measures. *Cholan* does not appear to exhaust the soil fertility any more than *Cumbu* and neither deep ploughing nor the application of humus in the shape of sunhemp compost had any effect on *cholan* soils as could be seen from the low yields of succeeding cotton. The conclusion arrived at in previous years that, while *cholan*, when allowed to run into seed, seriously affected the yield of succeeding cotton, no such adverse effect was observed when it was cut at shot blade stage was once again confirmed. Attempts are being made to find a way to obtain a large yield of *cholan* fodder when cut at shot blade stage by sowing fodder late in the season when there is not enough moisture in the soil to keep the plants growing, by thick sowing, by growing a mixture of *cholan* and one or more suitable pulse crops, by preventing *Cholan* plants from running into seed by cutting ear heads at the flowering stage and other means.

48. *The Nadam Cotton Breeding Scheme*, which commenced in February 1933, has for its object the selection of suitable annual types of cotton to replace perennial *Nadam* (*G. obtusifolium*) in the red soil tracts of Salem and Coimbatore districts where due to the poverty of soil and precarious rainfall neither *Karunganni* (*G. indicum*) nor *Uppam* (*G. herbaceum*) grows satisfactorily. *Nadam* being a perennial cotton, provides a convenient breeding ground for the stem-weevil and pink boll-worm during the close period of *Cambodia* prescribed by the Madras Pest Act and if an annual variety suitable for these tracts is secured, it will be possible to extend the Pest Act all over Salem and Coimbatore districts without exception and thus avoid damage to *Cambodia* cotton. The work of the year under report shows that there is a good prospect of securing an annual type which can replace *Nadam*. The season was very unfavourable with a low rainfall of 21 inches against an average of 30 inches. Sowings had to be delayed till the third week of October for want of timely rains and the total rainfall received throughout the growing period of cotton was only 4.35 inches. Even under these adverse conditions, three cultures of *Nadam*, nine of F 3 crosses of *Nadam* and *Karunganni* and thirty F 3 and F 4 crosses of *Cambodia* and U 4 were expected to yield about 200 lb. of *kapas* per acre against about 80 lb. of *Nadam* in the second year when highest yield of this cotton is usually expected. A large number of plants have also been selected for earliness from F 2 cross of Co. 2  $\times$  U. 4 and from a back cross of (*Nadam*  $\times$  *Karunganni*)  $\times$  *Karunganni* and from various varieties sown in bulk.

#### BOMBAY PRESIDENCY.

49. *Broach Cotton Breeding Scheme*.—The chief aim of this scheme which was started in April 1932 is to obtain for Nerbudda-Mahi zone suitable types of cotton with wilt-resistant, heavy yielding, high ginning (40% and above) and superior spinning qualities to replace the local mixture which consists of a large percentage of *Goghari*, a rough and short staple variety susceptible to wilt but

with a high ginning outturn up to 40 per cent. In view, however, of the recent change in the Committee's policy to replace, wherever possible, short staple cotton with medium and long staple varieties, efforts are now concentrated only on wilt resistance, heavy yield and fibre length. During the year under report four crosses, viz., (1) *B D 8 x G A 26* (fourth generation), (2) *B D 8 x G A 26 F1* back crossed to *B D 8* (second generation), (3) *B D 8 x S 7-1* (second generation) and (4) *B D 8 x S 12-1* (first generation), were studied in detail. Of the 66 families belonging to cross No. 1, two were found entirely free from wilt, seven with 1 to 5 per cent attack and in the rest the attack varied from 6 to 60 per cent, 76 wilt resistant plants with 35 and above ginning percentage and 20 to 23 m m fibre length have been selected for further examination in 1935-36. Cross No. 2 appears to be more vigorous and prolific than a simple cross between *B D 8* and *G A 26* and from the 15 cultures of this cross which were examined during the year, 66 plants with 35 to 42 per cent ginning outturn and fibre length of 20 to 23 m m have been retained for further tests. Cross No. 3 is a little susceptible to wilt but has good staple and medium ginning outturn. Forty-three plants of this cross with 35 and above ginning percentage and staple length of 20 to 23 m m have been selected for further study next year. Cross No. 4 resembles *B D 8* a long staple variety with low ginning percentage, in height, vigour and staple length and *S-12 1* in fruiting and bearing. Its ginning outturn is midway between the two parents. Fresh crosses have been made between (i) *B D 8* and *1027 A L F* and (ii) *B D 8* and *NS 12*. Of the single line selections, *NS 12* has again proved satisfactory for wilt resistance and other economic characters.

50 *The Jalgaon Cotton Breeding Scheme*, like the Broach scheme, was started in April 1932 with the object of securing by selection or hybridisation wilt-resistant, heavy yielding, high ginning and fine spinning types of cotton to replace local *NR* and *Banilla*, a cross between *Bani* and *Comilla* in Khandesh. *Banilla*, though only equal in yield, is superior to local *NR* in ginning outturn and spinning quality. It is, however, susceptible to wilt and has considerably deteriorated in spinning quality from the time it was first introduced. The three selections, viz., *NV 57 7*, *NV 56 3* and *NV 56 17*, which looked promising last year, were again found this year better yielders than *Banilla* and *NR 6* and did not suffer from the bad effects of continuous rains after sowing. They are also wilt-resistant and much superior to *Banilla* in fibre length. One of them, *NV 57-7*, is typically sympodial and matures earlier than the other two selections but it is slightly inferior in ginning percentage.

51 *The Scheme for Survey of Goghari Cotton in Gujerat* is a necessary corollary to the Committee's policy of encouraging exclusively the cultivation of *1027 A L F* in the tract lying south of the Nerbudda in Gujerat and to the seed scheme sanctioned in August 1934 for the extension of this cotton. The scheme has for its object the field survey of *Goghari*, an inferior short staple variety, with a view to trace it to gineries and induce them to discourage its cultivation by refusing to pay high price for it. Frost damage during the year made the survey difficult but the results obtained nevertheless indicate the wide distribution of *Goghari* either as pure or mixed crop. Gin-owners failed

to co-operate with the Department of Agriculture and it is intended to approach them once again next year through the Gujarat Divisional Cotton Committee and the East India Cotton Association, Bombay.

52. *Plant Puller Propaganda Scheme in Surat and Broach Districts.*—This scheme is the natural consequence of the Surat Boll-worm Clean-up Scheme which was sanctioned in December 1930 for the purpose of demonstrating to the cultivator in Gujarat the advantages of uprooting cotton stalks and stubbles before the end of May and thus depriving the pink and spotted boll-worm of the food material till the next crop of cotton. The clean-up scheme was quite a success as it clearly demonstrated that by clean-up measures the cultivator could obtain 25 to 30 per cent. more yield and on the termination of this scheme in April 1934, the Committee sanctioned in the first instance for one season of four months the plant puller scheme with the object of popularising the cotton plant puller, a cheap and effective implement, for uprooting cotton plants. The plant puller propaganda was continued during the year by means of public lectures, magic lantern shows and practical demonstrations and as a result of this activity the Department of Agriculture could distribute in the North of the Nerbudda 1,282 plant pullers in addition to another 2,158 pullers sold by local merchants. In the south of the Nerbudda the demand for plant pullers was much greater and the Department of Agriculture could not obtain for this tract more than 1,536 pullers which were disposed of very quickly. The total area cleared is estimated at 80 per cent. in Broach, 90 per cent. in Amod, 75 per cent. in Wagra and 40 per cent. in Jambusar Talukas in the north of the Nerbudda and 22 per cent. of the total area under cotton in the south of the Nerbudda. A considerable area was thus left untouched due mainly to the new leases being delayed so late in the season that the incoming tenants has no time to pull out cotton stalks in time. To avoid this difficulty it is hoped that by the time the scheme terminates in June 1936 the Government of Bombay would pass necessary legislation on the lines of the Madras Pest Act to enforce the uprooting of cotton stalks every year before the prescribed date.

53. *The Scheme for Defibration of Cotton Seed* was sanctioned in August 1934. A defibration machine has since been purchased and installed at Palej, Broach district, and the machine will commence work in January 1936.

#### SIND.

54. *Sind Physiological Research Scheme.*—The main object of the scheme is to ascertain the optimum sowing time and irrigation and manurial requirements of cotton in the Barrage areas of Sind and it commenced work in July 1927. The work of the year under report is mainly a repetition of what was done during the last year and the results obtained are in conformity with those of previous years. The irrigation experiments show once again that the water requirements of cotton are the highest during the flowering and fruiting periods and that an initial irrigation of 8 inches during the 1st 28 days followed in order by two irrigations of 2.75" each at 20 days' interval, three irrigations of 2.75" each at 15 days' interval and 5 irrigations of 2.75" each of 10 days'

interval gives the highest yield. The manurial experiments also have given again best results when in addition to the initial application of compost before sowing at the rate of  $7\frac{1}{2}$  cart loads per acre, ammonium sulphate was applied at the rate of 100 lb per acre either in one dose when the crop is  $3\frac{1}{2}$  months old or in two equal doses one when the crop is  $1\frac{1}{2}$  months old and the second two months later. Observations on 'red leaf' were continued. The experiments for finding out the optimum time for sowing were not repeated in view of the definite conclusions already arrived at.

## PUNJAB

55 *Botanical Scheme* —The chief object of this scheme when it was sanctioned in 1925 was to investigate into the causes of the periodic failures of American cotton in the Canal Colonies where a very large area is annually under this cotton and to obtain suitable types of American and *Desi* cottons to replace 4F and *desi* cottons respectively. Efforts are, however, being concentrated from the beginning on the problem of breeding new types in view of their immediate economic importance and as will be seen below a separate Physiological Scheme has since been started for the enquiry of periodic failures. Mention was made in last year's report that after extensive tests of 36F, 38F, 43F, 45F and 47F strains under different conditions of soil and climate, the Department of Agriculture had decided to continue for one more year comparative tests between 43F and 38F, the two most outstanding strains, with a view to select one of them finally for general distribution in the province. They were accordingly tested during the year and the final choice fell on 43F, an early and jassid resistant type with  $1\frac{1}{2}$ " staple length and capable of spinning up to 44's. 38F is slightly inferior to 43F in staple length and is also susceptible to jassid attack. It may, however, prove useful in drier parts of the province. Three other American strains, 54F, 55F and 58F, have given promising results and they will be tested extensively in 1935-36. The *desi* type No. 39 which was issued last year for distribution has been spreading satisfactorily and two other *desi* strains are under severe tests.

56 *The Physiological Scheme* as mentioned above, was sanctioned in August 1933 for the purpose of ascertaining the causes of the periodic partial failure of American cotton in the Punjab and it commenced work in March 1935.

57. *Pink and Spotted Boll-worm Scheme* —In January 1926, the Committee sanctioned a Pink Boll-worm Scheme for the investigation of the causes responsible for the difference in the incidence of the pink boll-worm between South-East Punjab where its attack is severe and the Canal Colonies where it is negligible. The scheme came to an end in March 1934 when it was superseded by the present Pink and Spotted Boll worm Scheme for the continuation of the work on pink boll-worm and the enquiry of certain aspects of the spotted boll-worm. The results obtained from the Pink Boll worm Scheme have been given in previous reports and it will be seen from them that temperature and humidity are the main causes of the unequal distribution of the insect in the two areas. The work of the year indicates that the attack of the spotted

boll-worm is more severe in the Canal Colonies and Western Punjab than in the rest of the province where the pink boll-worm predominates. During the year under report the spotted boll-worm made its first appearance in the middle of June when the new crop was a few weeks old and continued boring the tender shoots till about the beginning of September when it commenced attacking flower buds and green bolls. Its damage, as was observed from the experiments of night caging, amounted to 47 per cent in the case of 4F and 65 per cent in the case of *desi*. The degree of attack varied with the types of cotton and the time of sowing. In the Punjab there is a close period of cotton sproutings from last year's stumps and on the host plants like *Malva Sylvestris*, *Abutilon indicum*, *Malva parviflora*, *Althearosca*, *Hibiscus esculentis* (*Bhindi*), etc. It is, however, interesting that for about six weeks of this period the only host plants available are the sprouts of cotton stumps and by removing them in time it may be possible to control the pest effectively. It is therefore proposed to start soon clean-up experiments over an area of not less than 150 square miles on the lines conducted in the Surat tract of the Bombay Presidency. Five parasites of the spotted boll-worm, viz., *Microbracon lefroyi*, *Malcha nursei*, *Rhogus testaceus*, *Elasmus* sp. and *Chalies trachardiace*, were observed at Rhotak and Lyallpur and from the data collected it is noticed that a temperature in the neighbourhood of 82°F is optimum for the increase of *M. lefroyi* while above 95°F and below 55°F no development of the insect takes place. The duration of the total life cycle of this parasite which attacks both spotted and pink boll-worms varies from 7 to 51 days. Work on the other four parasites is in progress.

58. *White Fly Scheme*.—White Fly (*Bemisia gossypiperda*) is a small sucking insect that does damage to cotton and other crops and was first observed at the British Cotton Growing Association's estate, Khanewal. In 1929 one of the Committee's scholars was deputed to study the insect and in 1930 the Committee felt convinced of the necessity of a more thorough investigation and sanctioned the White Fly Scheme which commenced in May 1931. During the year under report the white fly infestation was unusually low. As in previous years the attack was more severe on *desi* cotton than on American types till about the end of August when it decreased on all varieties. The pest, however, continued till about the end of the season, but from September onwards it was relatively more on two of the American varieties, 4F and L.S.S. than on *Mollisoni* (*desi*) and other American types tested, viz., 289F, 38F and 43F. During the period of severe infestation the vegetative growth of the crop was considerably affected and even stopped entirely in extreme cases, but when the infestation was removed either by natural means or by spraying, the crop appeared to recover more or less completely. It was, however, noticed that though the plants subjected to severe attack for one month in July and kept free before and after this period, seemed to suffer minimum damage they gave only 50 per cent of normal yield. Similarly when plants were infested for one month in August they gave very poor or minimum yield. Similar infestations for one month from the middle of July and from the middle of August gave the lowest ginning percentage and the lowest seed weight.



respectively. The infestation was the lowest when the soil was treated with iron sulphate, but this treatment decreased, irrespective of the degree of attack, boll formation and ginning percentage and increased flower and boll shedding. Infestation was comparatively higher when sodium nitrate and ammonium sulphate were applied as manure but they gave good boll formation, higher ginning percentage and low shedding. They had also very beneficial effect on yield when they were applied to poor soils towards the end of June and to rich soils in the latter half of August. No relation seems to exist between the degree of infestation and the percentage of water content in the leaf except that *Mollisoni*, which contains the least amount of moisture, suffered the most. Irrigation experiments have, however, confirmed the previous indication that the attack is more or less in inverse proportion to the quantity of water applied to the crop. Observations were continued on the incidence of the pest on different host plants during the different parts of the year and the data obtained confirm the results of the last year.

59 *The Punjab Spraying Trials Scheme* is the outcome of the White Fly Scheme which has given a definite indication of the efficacy of certain insecticides against the white fly pest without causing any material damage to the cotton crop. The results of sprayings on small areas were misleading as the insect could fly to the sprayed plants from the surrounding unsprayed areas and it was therefore considered necessary to test on a large scale the indications obtained from the investigations of the White Fly Scheme. The present scheme was accordingly started in July 1933 with the object of ascertaining (a) the most suitable and economic insecticide and the proper time for spraying or dusting and (b) the various methods and appliances for spraying and dusting the field crop of cotton. The results obtained in 1933-34 in regard to the cost of spraying rosin compound and rosin soap with Sapom sprayer, Hardie power sprayer and Orchard power sprayer and the percentage of mortality of the pest with each of these insecticides and sprayers have been given in last year's report. The trials were repeated during the year under report over an area of 2,640 acres at Khanewal, Okara and Sargodha. The results were again quite satisfactory with regard to the mortality of the insect. They also indicate that spraying is a profitable concern if it is done in proper time and that the number of spraying is not as important as the time of spraying. The trials will once again be repeated in a year of bad white fly attack.

60 *Root Rot Scheme*—This scheme which commenced in September 1932 has for its object the investigation of root rot in the Punjab where its annual damage to the cotton crop is estimated at Rs 1,600,000. Both *desi* and American varieties are equally susceptible to this disease which is rapidly spreading in all irrigated areas of the Punjab and contrary to the indications obtained last year the incidence of the disease on irrigated cotton does not appear to have any relation to the number of irrigations. The disease appears to be less severe on cotton sown in the middle of June than on cotton sown earlier and neither *desi* nor American varieties suffered much when they were grown under rain fed conditions. Root Rot, as explained in previous reports is caused by two species of *Rhizoctonia*. Their attack is more virulent when

they act together than when only either of them is present and their activity is increased by the presence of subsidiary fungi (*Fusarium sp.* *Helminthosporium sp.* *Alternaria sp.*) though they are by themselves harmless. The two causal organisms are most active at 35°C and their parasitic activity declines with the fall in temperature. The thermal death point of both the resisting bodies and mycelia of the two organisms is also about the same. The disease, as observed during the year, is carried over from year to year on live cotton roots in the soil.

#### CENTRAL PROVINCES.

61. *Botanical Scheme*.—This is one of the oldest schemes sanctioned in 1923 and has for its object the breeding of wilt resistant, heavy yielding and fine spinning types of cotton to replace the coarse local mixture in the Central Provinces and Berar. This scheme is the continuation of the botanical work which the Department of Agriculture had already started and it was therefore possible to secure within four years a good yielding wilt resistant type, *Verum 262* which could spin up to 22's as against only 10 to 12's of local cotton. This new variety soon became so popular with the cultivator, because of its high yield and the good premium paid for it, that the Committee felt convinced in 1929 of the necessity of sanctioning a seed distribution scheme with the help of which the Department of Agriculture were able to spread this cotton more quickly than otherwise. It was however soon found out that this cotton was susceptible to adverse climatic conditions and attention was therefore diverted to the selection from the material available of new strains free from this defect and if possible with better yielding and spinning qualities. Three such strains, *viz.*, *V. 434*, *Late Verum* and *V. 438*, have since been obtained and their distribution in the place of *V. 262* was seriously commenced during the year under report. *V. 434*, the best of the three new types, is hardy, prolific and superior in lint qualities besides being drought resistant and proved a great success during the year on an area of 2,000 acres under a wide range of conditions. It gave an average yield of 635 lb. of *kapas* (seed cotton) per acre on the Akola Farm and reports of similar encouraging yields have been received from everywhere it was tested. It is adjudged suitable for spinning up to 37's and was paid a premium of Rs. 10 to 20 per *khandy* of 784 lb. over *V. 262* and *Late Verum*. It was sold in the Central Provinces at Rs. 300 per *khandy* when *Oomras* and *Broach* were selling in Bombay at Rs. 212 and Rs. 227 respectively. This cotton is expected to occupy an area of 20,000 acres in 1935-36 season. *Late Verum* spins up to 36's and is well suited for localities where the rainfall is heavy and the monsoon extends late in the season. It was grown during the year on an area of about 16,000 acres and the results obtained were so satisfactory that it is expected to cover about 100,000 acres in the next season. *V. 438* was extensively tested for its suitability for soils of lighter descriptions and the results were quite encouraging. Steps have been taken to extend this cotton on areas for which it has been developed. The scheme has yielded several other strains of distinct promise which require further testing.

62. *The Entomological Scheme* was commenced in June 1934 for a preliminary survey of the cotton boll-worm pest in the Central Provinces and Berar.

where it has been doing considerable damage to cotton, with a view to ascertain its incidence, method of carry-over from year to year and the extent to which the results obtained from the Surat Entomological Scheme could be usefully applied in this province. The work of the year shows the presence of a much larger population of pink (*Platyedra gossypiella*) and spotted (*Earias spp*) boll-worms at Akola than at Nagpur which is probably due to more suitable climate and higher concentration of cotton cultivation at Akola. At both these centres the spotted boll-worm starts its attack on tender shoots when the crop is 3 to 4 weeks old and causes much damage to flower buds and green bolls from September onwards. The pink boll-worm, on the other hand, does not make its appearance till about September and its damage is negligible till the latter part of December by which time nearly 85 per cent of the crop is harvested. The pink boll-worm is not thus a serious pest in the Central Provinces and Berar though the combined effect of the two boll-worms is very severe towards the end of the season. The total loss due to the pink and spotted boll-worms is estimated, from the results of night caging experiments, at 51 per cent of the crop harvested. In addition only 77 per cent of cotton harvested is undamaged and of the rest, 20 per cent is made up of half eaten seed, the remaining 3 per cent being rendered useless. The spotted boll-worm is carried over from season to season by cotton plants left over in fields after harvest, tender shoots sprouted from cotton stubbles after hot weather showers, perennial cotton trees and several malvaceous plants. The method of carry-over of the spotted boll-worm is thus practically identical in the Central Provinces and Berar and the Surat tract of the Bombay Presidency where this pest was studied in detail for 8 years from 1923 to 1931. This shows that the only possible practical remedy for the spotted boll-worm lies in clearing up immediately after harvest of all cotton stalks and stubbles and the eradication of other malvaceous plants that harbour the insect. The pink boll-worm lives during the off-season in cotton plants left over after harvest, perennial cotton trees, unginned cotton, stacks of cotton stalks and soil cracks in fields.

#### UNITED PROVINCES.

63. *The Cotton Survey Scheme* was started in July 1933 for the detailed survey of the *Bengals* types of cotton grown in Rohilkhand and Bundelkhand to facilitate the selection of suitable types of cotton for the different cotton growing areas of the province. In 1933-34 about 5,000 samples of cotton were collected from as many as 1,852 villages in Rohilkhand and the best 396 of them were tested in 1934-35 for purity. Most of these samples were found to be crosses and were therefore discarded. From the few samples that appeared to be pure 443 plants were selected and examined for all important characters and the most promising of them would be further tested in 1935-36. Similar survey was started in Bundelkhand during the year under report when over 6,000 samples of cotton were obtained from 1,101 villages, and the best of them will be tested next year for purity in a Government Farm. It was observed during the survey that the yellow flowered and narrow lobed type of cotton was most predominant throughout Bundelkhand while the white flowered type was confined only to localities where the means of

communication was good and the Department of Agriculture had distributed pure seed. It was also observed that in places, far away from towns and regular markets, the crop on the whole was more homogeneous and better in staple than in other localities. Better types of cotton were seen growing in Mohoba *Tehsil* of Hamirpur district, Lauri *Tehsil* of Chatterpur State, Moth *Tehsil* of Jhansi district and Tehrauli *Tehsil* of Orchha State.

#### BURMA.

64. *Cotton Improvement Scheme*.—The local practices of dry cultivation in Burma are still so unsatisfactory that unless the cultivator is first taught the better methods of cotton cultivation there is little advantage of the distribution of the improved strains of cotton which the Department of Agriculture have been able to secure. The main object of the scheme is therefore to bring into general agricultural practice the up-to-date methods of cultivation by means of demonstration holdings in suitable centres and the scheme commenced in April 1931. The work of the year continued on the same lines as in previous years. There were in all 24 Demonstrators in charge of 75 holdings in Meiktila, Myingyan, Sagaing and Lower Chindwin districts. The demonstration holdings are producing conspicuous effect on the cultivators and the improvement obtained in many of these holdings after a few years' work is very encouraging. During the year under report the average yield of seed cotton on demonstration holdings amounted to 315 lb. per acre against 240 lb. in Meiktila district, 197 lb. against 172 lb. in Myingyan district, 255 lb. against 211 lb. in Sagaing district and 311 lb. against 244 lb. in Lower Chindwin district. Drill sowing increased from 2,607 acres in 1931-32 to 12,328 acres in 1934-35 and a large number of cultivators round about the demonstration holdings have adopted several improved methods such as the layout of fields, bullock cultivation, conservation of manure, etc.

#### HYDERABAD.

65. *Botanical Research Scheme*.—Hyderabad is the third biggest cotton growing territory in India, and had some years back the reputation of producing one of the best indigenous cottons, viz., *Gaorani* or *Bani*, a long staple variety with low ginning percentage. This cotton has been now largely replaced by high ginning short staple *neglectums* and the object of the scheme, therefore, is to study the several varieties of cotton now grown in Hyderabad and secure from them a few high ginning medium staple types to replace the present mixtures in different parts of the State. The scheme commenced in 1929 and of the large number of pure strains that have been since then obtained *Gaorani 4*, *Gaorani 6*, *Gaorani 55* and *Parbhani 25*, which were found promising last year, have again proved this year their superiority in all important respects over the control, local *Gaorani Umri*. Among the four new strains themselves, *Gaorani 4* appears to be most promising though it is slightly inferior to the rest in ginning percentage and to *Gaorani 6* in spinning value. It has staple over  $\frac{7}{8}$ " long suitable for spinning up to 34's. *Gaorani 4* and the next best strain, *Gaorani 6*, have also given very encouraging results in district trials and it is proposed to distribute their seed in the next season for about 1,000 and 600 acres respectively. In another set of comparative tests between *Gaorani 9*,

*Gaorani 12*, *Parbhani 9*, *Havri 3* and *Parbhani* local, only one strain *Havri 3*, a *roseum* type, came up to the level of *Parbhani* local in yield. *Havri 3* and *Parbhani 9*, a *Banilla* type, gave higher ginning percentage while *Gaorani 9* and *Gaorani 12* had longer staple length than the rest. There were two other sets of preliminary comparative tests for the latest strains. Eight of these strains from one set and six from the other have been selected for further trials. Purity tests were as usual continued.

66. *The Cotton Survey Scheme* is a natural consequence of the above scheme and has for its object a detailed survey of the cottons grown in Hyderabad as an essential preliminary for the selection of suitable strains of cotton. It commenced in June 1931. During the year under report, 207 samples of cotton—119 of *Kharif* and 88 of *Rabi*—were obtained from Mahbubnagar, Medak, Nizamabad, Raichur, Karimnagar, Asifabad, Warangal and Nalgonda districts and an examination of these samples, after growing them in Parbhani and Rudroor Farms, has shown that over 95 per cent of the *Kharif* crop grown in all the above districts consists of *G. indicum*, *G. neglectum* and *G. hirsutum* with 1 to 8 per cent of *Rabi* types, viz., *G. herbaceum*, *G. obtusifolium* var *Cocanada* and the *Rabi* type of *G. indicum*. The analysis of *Kharif* samples discloses that in Parbhani, Bir and Raichur districts the bulk of *Kharif* crop, upto 70 per cent, is made up of *G. neglectum* with *G. indicum* up to 20 to 30 per cent in the first two districts and about 15 per cent in the third. In all the remaining districts the proportion of *G. indicum* is as high as 50 to 95 per cent against 1 to 33 per cent of *G. neglectum*. *Rabi* samples, on the other hand, indicate that *G. herbaceum* is almost the only type grown as *Rabi* crop in Karimnagar district and the northern part of Warangal district. Similarly *G. obtusifolium* in Nalgonda district and the southern part of Warangal district and *G. indicum* in Asifabad district are more or less the only cottons grown as the *Rabi* crop. The above analysis of the *Kharif* and *Rabi* crop agrees more or less with the results of the survey of standing crop carried out during the year in 147 villages of all the above mentioned districts.

67. *Pink and Spotted Boll-worm Scheme*.—This scheme is the outcome of the preliminary investigations carried out in 1931 and 1932 by the Cotton Research Botanist, Parbhani, which gave an indication of the part played by the pink and spotted boll-worms in Hyderabad. In the light of this information the Committee felt convinced of the necessity of starting a detailed enquiry of these pests and sanctioned the scheme which commenced in June 1933 for finding out (a) the actual amount of damage done by them to cotton in the Godavary Valley, (b) the progress of their attack on the growing crop, (c) the mode of their carry-over from season to season and (d) the effect of the likely control measures. The work of the year shows that the spotted boll-worm is practically never absent and is seen breeding during the off-season on cotton plants left over in fields and alternative host plants, while the pink boll-worm does not make its appearance till June. By about August when all cotton fields of the previous season are ploughed up for the next rotation crop the two boll-worms are seen having passed over to the new cotton crop. In September and October the spotted boll-worm increases in numbers at a much quicker rate than the pink boll-worm but from November onwards the latter

outstrips the former. The maximum incidence of the attack of the spotted boll-worm is attained in about the middle of December when it commences to decline till about the middle of February when it again starts increasing. The pink boll-worm pest on the other hand reaches its maximum in January-February and begins to decrease thereafter till it becomes negligible at the end of April. The combined average maximum intensity of attack of the two boll-worms for any one week during the year was 21 per cent on flower buds, 57 per cent on flowers and 58 per cent on green bolls, the actual average loss of yield for the whole season being 18 per cent. It has been ascertained that due to the local practice of renewing the leases of cultivated fields every year, over 13 per cent of the area sown to cotton in the Godavary Valley remains uncultivated till about June and even later and the cotton plants of the previous season left remaining in the uncultivated area serve as a breeding ground for the pink and spotted boll-worms during the close period. The spotted boll-worm is seen breeding on other host plants which do not appear to play any part in the carry-over of the pink boll-worm. The two boll-worms hibernate in the soil but while the larvæ and cocoons of the spotted boll-worm were found in the soil only for about a fortnight after the removal of cotton stalks, pink boll-worms were found even after the soil was ploughed. In Hyderabad, unlike in other provinces, cotton seed does not appear to serve as a means of the carry-over of the pink boll-worm, probably due to severe summer heat.

#### BARODA.

68. *The Root Rot Scheme* commenced in February 1932 for the purpose of studying the root rot disease and breeding root rot resistant strains with high yielding and good spinning qualities to replace the local cotton in Baroda. The work of the year is for the most part a repetition of what was done last year. Cultures from the affected parts of cotton roots have given again the same organisms as were observed in previous years, viz., *Macrophomina phaseoli* (*Rhizoctonia bataticola*), *Cephalobus* species of nematodes and *Fusarium vas infectum*. These organisms were also observed again in the roots of several other crops and weeds suffering from root rot disease. *Rhizoctonia* is found to be the real cause of the disease and it enters cotton roots through the injuries caused to their tender rootlets by nematodes. Other organisms present are harmless. *Rhizoctonia* and nematodes have been traced up to two feet below the soil surface but their activity is mostly confined to the first one foot. *Rhizoctonia* is most active at temperatures between 30°C and 40°C and at 30 per cent humidity. These conditions are usually present when cotton is sown by the aid of irrigation in summer months and this appears to be the reason for severe root rot disease on cotton grown in May under irrigation. The thermal death point for the *Sclerotia* of *Rhizoctonia* is 60°C which is much above the temperature ever observed at any part of the year in Baroda. Nematodes have their optimum temperature at 25°C—30°C and thermal death point at 50°C. Manurial trials and disinfection treatments have not given any significant results. On breeding side, two varieties of cotton, viz., *Rozi* and *Karkhadi* and two pure strains, *Broach 9* and *Broach 8*, have been found more tolerant to root rot than other cottons grown in Gujerat. A few selections

have been made from some pure types and they will be further examined in the next season.

69. *Goghari Cotton Survey Scheme*.—This scheme which is similar to the *Goghari* cotton survey scheme in the Bombay Presidency was sanctioned in August 1931. The field survey during the year shows that while 10 per cent of the cotton crop in the Navsari area was *Goghari*, very little *Goghari* mixture was observed in Palsana, Mahuwa and Gandevi talukas.

#### BIKANER.

70. *The Gang Canal Scheme* has for its object the selection of superior types of cotton which could spin up to 25's and the study of certain agricultural problems. It was started in January 1931. The results so far obtained definitely indicate that under the present agricultural conditions Cawnpore 520 (*desi* type) is best suited to the Gang Canal area and a beginning has been made to multiply this seed for general distribution. *Cawnpore 520* gives the highest yields when it is sown in June while for *Mollisoni* the next best type, the best sowing period is the middle of May or early June. *Mollisoni* gives satisfactory yields with even three irrigations when they are suitably adjusted, while 289-F requires 6-11 irrigations, but both the types are adversely affected in regard to staple length and ginning percentage when the number of irrigations is decreased. Fallow and compost treatments have little or no effects on cotton while it responds favourably to green manuring.

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## CHAPTER V.

### SEED DISTRIBUTION SCHEMES.

71. THE Indian Central Cotton Committee felt convinced in 1929 that botanical and other research on cotton was of little consequence unless the results were made easily available to the cultivator and adopted accordingly the policy of helping the Departments of Agriculture and Co-operative Sale Societies in wider distribution of pure seed of the improved varieties of cotton. Sixteen seed schemes have since been sanctioned. Thirteen of them including the United Provinces C. 402 Scheme, which was started only in May 1935, are now under operation and one scheme for the sale of all farm crop produce in the Punjab was withdrawn during the year. The remaining two schemes, *viz.*, Bilhongal and Haveri, have not yet been commenced for one reason or other though they were sanctioned as far back as in November 1929.

#### MADRAS PRESIDENCY.

72. *Tiruppur Co. 2 (Cambodia) Seed Extension Scheme.*—The Committee sanctioned in 1929 a small scheme, the Madras (Tiruppur) Seed Extension Scheme, providing the pay of an officer to act as an advisor to a group of Co-operative Societies in Coimbatore District which had been interested in the distribution of Co. 2 seed, and the scheme started in May 1931. It was amalgamated in 1933 with a new seed scheme, Tiruppur Co. 2 (Cambodia) Seed Extension Scheme, sanctioned in August 1932 for the distribution of Co. 2 seed in Salem and Coimbatore districts through the agencies of the Agricultural Department and the Tiruppur Co-operative Trading Society. The Department of Agriculture with the help of the Committee's grants arranges every year a seed multiplication area of about 6,000 acres, while the Tiruppur Co-operative Trading Society has undertaken to gin pure all the seed cotton obtained from the above area and distribute the seed to cultivators for about 100,000 acres. The Society in return has been guaranteed its actual loss on seed transactions upto a maximum of 10 per cent of the capital invested for the purchase of seed and interest thereon at 5 per cent. The Department of Agriculture arranged during the year a seed farm area of 4,122 acres which yielded 1,106,700 lb. pure seed. About a third of this quantity had to be discarded as it was found unfit for sowing and the rest was distributed for an area of about 29,600 acres.

73. *The H1 (G. herbaceum) Seed Extension Scheme* has been suspended due to the difficulty of securing local co-operation in the supply of improved seed in the Bellary district. The question of a revised scheme is under consideration.

#### BOMBAY PRESIDENCY.

74. *Hubli Seed Extension Scheme.*—The main object of this scheme which came into operation in June 1930 is that every year the Department of Agriculture should maintain a total seed multiplication area of about 16,000



acres of *Jayawant* cotton and the seed obtained from this area should be purchased and distributed by the Hubli Co-operative Cotton Sale Society for about 200,000 acres. The Committee has in its turn agreed to meet the cost of roguing the crop of the seed multiplication area and to pay the Society a subsidy not exceeding Rs. 5,000 per year to cover its loss, if any, on its seed transactions and interest at 5 per cent on the capital invested for the purchase of seed. The Department of Agriculture has till now fully discharged its obligations by maintaining the seed multiplication area as stipulated in the scheme. The area covered by the Society, however, fell short of expectation every year for one reason or other. During the year under report the Society was able to distribute 1,462,861 lb. of *Jayawant* seed enough for 146,286 acres, the largest area covered by it since the beginning of the scheme.

75. *The Gadag Seed Extension Scheme* is very similar to the above scheme except that the seed multiplication area required to be maintained in this scheme is 24,400 acres of *Gadag 1* cotton as against 16,000 acres of *Jayawant* in the Hubli Scheme and it commenced in June 1930. The area covered by the Gadag Society did not exceed 100,000 acres in any one year except in 1931-32 when it was able to distribute enough seed for 125,000 acres, while the Department of Agriculture maintained the stipulated area for seed multiplication. The Society stocked and distributed during the year under review enough seed for 90,250 acres.

76. *Surat Seed Extension Scheme*.—This scheme was first sanctioned in 1929 for two years and was extended in 1931 for another two years pending the final decision of the Committee with regard to its policy in Surat area. The Committee in January 1934 after full consideration of the merits of the two rival cottons *1A* and *1027 A.L.F.* finally decided to confine its attention to the latter and extended the scheme for a further period of five years. The Department of Agriculture arranged during the year a seed multiplication area of 14,347 acres and distributed 1,506,225 lb. of *1027 A.L.F.* seed in Surat-Broach tract besides supplying another 377,829 lb. to the adjoining States of Chhota Udepur and Baroda. In addition the Hansot Co-operative Cotton Sale Society distributed in the area served by it another 428,734 lb. obtained from its members. It is gratifying that many Cotton Sale Societies, which had been till recently opposed to the distribution of *1027 A.L.F.* seed, have now accepted the Committee's policy and purchased large quantities of this seed.

77. *The Khandesh Seed Extension Scheme* was started in May 1931 with the object of extending *Banilla* cotton, a cross between *Bani* and *Comilla* cottons, in the Khandesh area. This cotton is susceptible to wilt and has also suffered in spinning quality since its first introduction; with all its defects, however, it is much superior to local cotton and gives better returns. It became therefore so popular with the cultivator in 1930 that it began to spread rapidly on its own merits and the Committee thought it desirable to sanction the scheme with a view to make this seed easily available in adequate quantities till a better strain is obtained from the Jalgaon Cotton Breeding Scheme. The

Department of Agriculture maintained during the year a seed multiplication area of 15,985 acres which produced 1,965,000 lb. pure seed enough to cover an area of 65,000 acres in the next season. Pure *Banilla* fetched a premium of Rs. 10 to Rs. 15 per Bombay *khandy* over local cotton.

78. *Athani Seed Extension Scheme*.—The object of this scheme which commenced in April 1932 is similar to that of the Hubli Seed Extension Scheme, *viz.*, the multiplication and distribution of *Jayawant* seed in the Athani Taluka of Belgaum district, the only difference between the two schemes being that while the Athani scheme is under the entire control of the Agricultural Department, the Hubli scheme is controlled partly by the Agricultural Department and partly by the Hubli Cotton Sale Society. The total seed multiplication area expected to be maintained during the year according to the original programme was 11,100 acres, but due to the loss of cotton crop by floods last year and consequent dearth of pure seed, it had to be reduced to 4,594 acres from which 421,232 lb. seed were obtained for distribution in the next season, for the same reason the total quantity of *Jayawant* seed distributed to the cultivators during the year under report was enough only for about 27,650 acres.

79. *The Deccan Canals (Banilla) Seed Extension Scheme* is practically self-supporting unlike other seed schemes, its recoveries being expected to cover its entire cost. Under irrigation in the Deccan Canal area *Banilla* gives as high yield as local *N. R.* and brings a premium of about Rs. 15 per 500 lb. of seed cotton over the latter. The total area expected to be covered by this cotton is, however, only 30,000 acres. The Committee in 1934 considered the advantages of replacing *N. R.* with *Banilla* in this tract and sanctioned the scheme with a view to provide the cultivator with pure *Banilla* seed in sufficient quantities. During the year under review 32 acres of Kopergaon Farm were sown to pure *Banilla* and of the total quantity of 18,650 lb. of seed obtained, 18,000 lb. were supplied to seed growers the rest being retained for sowing on the Farm next year.

80. *Sind Cotton Extension Scheme*.—This scheme was started in April 1931 with a view to introduce cotton cultivation in areas where this crop was not grown before and to extend improved varieties in localities where cotton had already been established. The work continued more or less on the same lines as in previous years on both the left bank and the right bank of the Indus. On the left bank the main items of work consisted of (i) comparative tests of improved cottons, (ii) trials of high quality cottons such as *Sea Island*, *Ashmouni*, etc., and (iii) multiplication and distribution of improved seed. In comparative trials the same four varieties that were tested in previous years, *viz.*, 27 *W. N.* or *desi* (36 ginning percentage,  $\frac{3}{8}$ " to  $\frac{4}{8}$ " staple length and 6's highest warp count), 4F-98 (34 ginning percentage,  $\frac{7}{8}$ " staple length and 30's highest warp count), 285F-2 (30 ginning percentage, 1" staple length, and 40's highest warp count) and 289F-1 (30 ginning percentage, 1" to  $1\frac{1}{8}$ " staple length and 40's highest warp count) were again tested in replicated plots in as many as 43 different centres and the results show once again close competition between 27 *W. N.* and 289F-1 for highest yield. 289F-1 gave the highest average yield in Southern Jamrao and Eastern Nara tracts of Thar

Parkar district and in the northern part of Hyderabad district, while 27 W N, closely followed by 289F-1, took the highest place in northern Jamrao tract, southern part of Hyderabad district and in Naushahro and Nawabshah Divisions of Nawabshah district. High quality cottons, *Ashmouni* 37, *Boss III-16* and *Sea Island 2-4* were tried in nine centres in Southern and Northern Jamrao tracts and the results surpassed even the highest expectations. The Department of Agriculture organised a seed multiplication area of 2,710 acres and distributed 785,335 lb of pure seed in addition to 411,430 lb distributed by the Sind Provincial Co-operative Bank. A very important feature of the left bank during the year was the keen demand for 289F-1 seed not only in Thar Parkar district where this cotton is extensively grown, but also in Nawabshah and Hyderabad districts where only *desi* types were hitherto under cultivation.

On the right bank cotton cultivation was unknown till 1931-32 when on starting the scheme a small area of 25 acres was for the first time brought under this crop. With this small beginning the area under cotton increased to 4,000 acres during the year and there is every prospect of this crop extending over a very large area. The results of the past four years indicate that 4F is better suited for the right bank than *desi* or any other cotton so far tested and that the soils of Dadu district are better fitted for cotton cultivation than those of Larkhana district which have been for a long time under rice cultivation.

#### CENTRAL PROVINCES AND BERAR.

81 *The Verum Seed Distribution and Marketing Scheme* —The main object of this scheme when it was started in September 1930 was to extend *Verum* 262, but on the expiry of the scheme in July 1934, the Committee in pursuance of its new policy to encourage wherever possible medium and long staple cottons in short staple areas, sanctioned this combined seed distribution and marketing scheme for the extension and marketing of long staple cottons. The total quantity of pure seed distributed during the year amounted to 3,099 *khandies* (2,429,616 lb) which were enough for sowing on 110,000 acres. 5,277 *khandies* (4,137,168 lb) of pure seed were purchased and stocked for distribution in 1935-36 season. The Department of Agriculture were also able to arrange the sale of 5,750 bales of pure cotton at a premium ranging from about Rs 13.5 to Rs 90 per *khandy* of 784 lb over *Broach*, the average premium for the whole lot works out at Rs 62.3 over *Broach* and Rs 82 over *Oomras* on the basis of F O R Bombay.

82 *The Hyderabad Seed Extension Scheme*, which came into operation in March 1930, has for its object the extension of *Jayawant* and *Upland* varieties in Raichur Gulburga area. The total quantity of pure seed distributed during the year amounted to 487,782 lb but due to the scanty rainfall at the time of sowing, only a small portion of this seed was sown on an area of 6,370 acres against 24,000 acres of the previous year. The Department of Agriculture made a serious effort to organise a large seed multiplication area but it ended

in disappointment for want of rains. They had therefore to depend once again on Hubli, Gadag and Kopbal Cotton Sale Societies for their seed supply in 1935-36 season.

#### BARODA STATE.

83. *Baroda Seed Extension Scheme*.—The object of this scheme is similar to that of the Surat Seed Extension Scheme, *viz.*, the extension of 1027 A.L.F. cotton in Baroda State and it started work in April 1934. During the year under review the Department of Agriculture distributed a fairly large quantity of 231,285 lb. pure seed enough for sowing on 20,230 acres including the seed multiplication area of 5,382 acres. In Baroda as in other parts of Gujarat cotton suffered heavily from frost and the Department of Agriculture have made necessary arrangements to meet the demand for pure seed during the next season.

#### RESEARCH STUDENTS.

84. Ever since its establishment the training of research workers in the various branches of science pertaining to cotton has been one of the Committee's principal concerns. Distinguished graduates are selected and placed for training under experienced research workers either on the Committee's schemes, at the Institute of Plant Industry, Indore, at the Committee's Technological Laboratory or under Professors in Indian Universities. Sometimes scholarships are awarded to students for training abroad at recognised institutions. The term of scholarships is usually two years, but extensions are sometimes sanctioned if found necessary.

Scholarships are awarded under two categories, *viz.*, Training Grants and General Scholarships. The former are intended for Government servants who are recommended by provincial governments and for employees of the Committee who are considered suitable. General Scholarships are awarded to University Graduates who are selected by the Research Students Selection Sub-Committee. Applications for this class of scholarships are invited by advertisement in leading Indian newspapers.

Fifty-two research scholarships and six training grants have so far been awarded by the Committee; out of these one scholarship and four training grants were for foreign study. During the year under report eight research students were under training—three in India and five abroad. Only one scholarship was awarded during the year.

Expenditure on Research Studentships up to the 31st August 1935 amounted to Rs. 243,145-2-4.

P. H. RAMA REDDI,  
Secretary.

## CHAPTER VI.

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### ANNUAL REPORT OF THE DIRECTOR, TECHNOLOGICAL LABORATORY, FOR THE YEAR ENDING 31st AUGUST 1935.

THE present report contains an account of the work done at the Technological Laboratory from 1st September 1934 to 31st August 1935. A notable event in the life of the Laboratory which took place during this period was the extension of several of its sections. The work of the Laboratory had grown steadily from year to year, during the past few years especially it had increased at a high rate. In order to cope with this increase in the work, it had become necessary to employ more staff and to install more machines and testing apparatus from time to time. As a result the Spinning Room, the Yarn Testing section and the Fibre Testing section had become overcrowded to an extent which threatened to lower the efficiency of the work. Moreover, the blow room plant of the Spinning Laboratory was installed more than 10 years ago. With the recent improvements in the design and construction of the blow room machinery some of our machines had become obsolete. In view of the fact that the Indian Central Cotton Committee aims on the one hand at maintaining a high standard of efficiency in the work of the Laboratory and, on the other, at keeping in the van of the progress by employing most modern machinery and testing apparatus, it was felt that the time was ripe for relieving the pressure on the testing resources of the Laboratory and for overhauling the blow-room machinery. Full details of the extensions carried out with these two objects will be found on page 66. The work done at the Laboratory will now, as usual be described under the following five heads —

- I Spinning Laboratory.
- II Research Laboratory
- III Moisture Testing Section
- IV Publications
- V General

#### I SPINNING LABORATORY

The following statement gives a summary of the samples of different cottons tested at the Laboratory during the period under review together with the names of the suppliers of the samples

#### BOMBAY

- (1) *The Cotton Breeder, S M C Dharwar* — 9 samples of Jayawant and other cross strains

- (2) *The Cotton Breeder, Jalgaon*.—18 samples of Banilla, N. R. and local cottons.
- (3) *The District Cotton Overseer, Hubli*.—One sample of Jayawant cotton.
- (4) *The Principal Agricultural Officer, Padegaon*.—9 samples from irrigation and soil experiments.
- (5) *The Cotton Breeder, Surat*.—4 samples of different strains and 4 samples of 1027 A. L. F. and B. D. 8 mixings.
- (6) *The Superintendent, Agricultural Station, Broach*.—One sample of B. D. 8.
- (7) *The Cotton Breeder, Broach*.—Two samples of selections, one of Broach Local, and 3 samples of B. D. 8 and other strains.
- (8) *The Cotton Breeder, Viramgam*.—One sample of Wagad Local, Wagad 8 and 3 selections and 4 samples of B. D. 8 and other selections.
- (9) *The Officer in charge, Government Seed Farm, Mirpurkhas*.—10 samples from irrigation and manurial experiments.
- (10) *The Botanist in Sind, Sakrand*.—One sample of 4F cross strain, 7 samples of Boss III, Sea Island and other strains.
- (11) *Cotton Supervisor, Indus Right Bank, Dadu*.—3 samples of 289F-1 and other strains.
- (12) *Cotton Physiologist, Agricultural Research Station, Sakrand*.—10 samples from irrigation and manurial experiments.
- (13) *The Agricultural Chemist and Soil Physicist, Sakrand*.—5 samples of 289F from irrigation experiments.

#### PUNJAB.

- (1) *The Cotton Research Botanist, Lyallpur*.—19 samples of different strains, 3 samples of 43F, Mollisoni and 289F.
- (2) *The B.C.G.A., Jhudo*.—One sample of Sind L. S. S.

#### UNITED PROVINCES.

*The Economic Botanist to Government, U.P., Cawnpore*.—7 samples of C. 402 and 520 selections.

## CENTRAL PROVINCES.

- (1) *The Economic Botanist for Cotton, C.P., Nagpur.*—3 samples of Bani and other selections and 5 samples of strains.
- (2) *Superintendent, Government Farm, Akola.*—One sample of Late Verum.

## MADRAS.

- (1) *The Cotton Specialist, Coimbatore.*—Six samples from rotation experiments, one of Co. 2 and 3 strains, one sample of Khlay cotton.
- (2) *The Superintendent, Agricultural Research Station, Koilpati.*—9 samples of different strains and one sample of Uppam cotton.
- (3) *The Farm Manager, Agricultural Research Station, Guntur.*—7 samples of different strains.
- (4) *The Assistant Director of Agriculture, Salem.*—2 samples of Co. 2.

## MISCELLANEOUS.

- (1) *The Director, Institute of Plant Industry, Indore.*—26 samples from multiplication, sowing, manurial, irrigation and other experiments; 5 samples of Malvi and other strains.
- (2) *The Agricultural Inspector, Devangere.*—One sample of Selection 69 and one of Local Sannahatti.
- (3) *The Agricultural Inspector, Chitaldrug.*—3 samples of Selection 69.
- (4) *The Senior Assistant Botanist, Mysore State, Bangalore.*—One sample of H. 190, 3 samples of Selection 69 and 10 samples of different selections.
- (5) *The Cotton Research Botanist, Parbhani.*—10 samples of Gaorani and other selections.
- (6) *The Agricultural Officer, Bikaner State, Ganganagar.*—Three samples of Mollisoni from irrigation experiments.
- (7) *The Crop Botanist, Malwa Division, Ujjain.*—10 samples of different selections.
- (8) *The Inspector, Cotton Seed Distribution, Kopbal.*—One sample of Jayawant.
- (9) *The Officer in charge, Cotton Research Station, Baroda.*—One sample of Broach 9.

- (10) *The Second Economic Botanist, Bengal, Dacca.*—One sample of Co. 2 (Bengal) cotton.
- (11) *The Director of Agriculture, Peredaniya, Ceylon.*—One sample of Cambodia cotton grown in Ceylon.
- (12) *The Senior Botanist, Bukalasa Experimental Station, Bombo, Uganda.*—8 samples of Uganda cottons.

It may be mentioned here that after a considerable lapse of time a sample of Cambodia cotton, of which seed had been obtained from the Madras Presidency, was received from the Director of Agriculture, Ceylon, where it had been grown. Also, another sample of the same cotton was received for the first time from the Second Economic Botanist, Bengal, Dacca. The receipt of these two samples at the Laboratory indicates the efforts that are being made in India and in adjacent countries to extend the cultivation of medium staple cottons.

The following tables give the distribution of samples, lots and counts spun and tested at the Laboratory in each season since 1924 :—

TABLE I.—*Distribution of Samples Spun, 1924-35.*

Province	1924-25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	Totals 1924-35
Bombay .. ..	18	26	22	22	28	66	89	69	143	111	97	691
Punjab .. ..	14	1	..	..	42	30	10	44	55	42	23	261
United Provinces ..	7	..	6	11	9	7	16	7	12	6	7	89
Madras .. ..	2	19	50	23	30	51	66	15	28	101	30	415
Central Provinces ..	2	..	3	2	2	5	3	3	5	0	0	43
Miscellaneous .. ..	3	11	..	6	6	27	28	33	75	97	85	371
Total .. ..	46	57	81	61	117	186	212	171	318	366	251	1,860
Standard Cotton Tests.	8	54	49	61	33	31	27	18	18	16	18	339
Trade Tests and Special Tests .. ..	..	..	..	..	..	37	80	134	125	166	131	682
Total Tests .. ..	54	111	130	128	150	257	328	323	461	548	400	2,890

TABLE II.—*Distribution of Lots Spun, 1924-35.*

Province.	1924-25	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35	Totals 1924-35
Bombay .. ..	36	52	44	44	53	107	90	69	143	111	97	846
Punjab .. ..	26	4	..	..	83	41	10	44	55	42	23	328
United Provinces ..	14	..	12	22	18	14	16	7	12	6	7	128
Madras .. ..	4	38	100	46	60	85	66	16	28	101	30	574
Central Provinces ..	3	..	6	4	4	10	4	3	5	9	9	57
Miscellaneous .. ..	3	22	..	12	9	33	20	33	75	97	85	398
Total .. ..	86	116	162	128	227	290	215	172	318	366	251	2,331
Standard Cotton Tests.	34	176	142	178	68	64	54	36	36	32	36	856
Trade and Special Tests.	..	..	..	..	..	37	119	186	129	175	175	821
Total Tests .. ..	120	292	304	306	295	391	388	394	483	573	462	4,008



TABLE III—*Distribution of Yarns Spun, 1924 35*

Province	1924 25	1925 26	1926 27	1927 28	1928 29	1929 30	1930 31	1931 32	1932 33	1933 34	1934 35	Totals 1924 35
Bombay	103	152	132	132	150	322	253	203	430	332	292	2 510
Punjab	106	14			254	113	31	136	165	127	72	1 018
United Provinces	27		36	60	54	42	40	22	32	18	21	358
Madras	12	108	278	138	180	255	199	53	85	303	90	1 701
Central Provinces	8		18	12	12	30	12	9	15	27	29	172
Miscellaneous	3	58		36	27	99	100	93	227	293	250	1 186
Total	259	332	464	384	686	861	635	516	934	1 100	754	6 945
Standard Cotton Tests	95	514	423	447	290	223	309	136	200	180	204	3 021
Trade and Special Tests						80	343	602	256	490	810	2 490
Total Tests	354	846	887	831	976	1 164	1 287	1 154	1,410	1 779	1 768	12 456

It will be seen that as compared with the last year the total number of samples and lots spun in the Laboratory shows a decline, though the number of counts spun during the period under review is practically the same. The decrease in the number of samples and lots is due to the fact that for more than six weeks the processing of samples had to be slowed down in order to allow the dismantling of some of the old machines in the blow-room and the erection of new machines. Furthermore, as the Yarn Testing Section was also enlarged during the period under review, the testing of yarns in this section had also to be retarded in order to make provision for the re-arrangement of apparatus and equipment in the enlarged room. Although, on account of these reasons there was a small decrease in the number of samples completely tested, yet, as will be seen from Table I even this reduced number is in excess of those for all the previous years excepting the last two years.

The statement given on page 43 does not include those small size samples of cotton which were received only for fibre tests, nor the samples of yarn on which tests were carried out at the Laboratory. The former relate to strains which are as yet in the early stages of experimentation and on which a fibre test is required by the cotton breeder in order to narrow down his field of selection so that he may grow in the subsequent seasons the most promising strains in quantities sufficiently large for a spinning test. A statement, giving a description of these samples, together with the names of the suppliers is given on page 56. The yarn samples are mostly received from mills or firms in their private capacity and are tested at the Laboratory on payment of certain fees laid down by the Indian Central Cotton Committee. A full schedule of the fees for the various tests which are performed for the benefit of mills and firms will be found on page 52.

The results of the tests carried out at the Laboratory are embodied in spinning test, fibre test and yarn test reports. These reports are sent to the suppliers of the samples, and in the case of agricultural samples submitted by the cotton breeders copies of the reports are also sent to their supervising officers. The results of tests, however, on the trade samples supplied by the East India Cotton Association and the Millowners' Associations of Bombay

and Ahmedabad are published in the form of Technological Circulars, which are distributed for general information among the trade and the industry. The following table gives a statement of the number of reports falling under each class which were issued during the period under review together with the corresponding numbers for last year :—

TABLE IV.—*Test Reports issued, 1924-35.*

	1924- 25.	1925- 26.	1926- 27.	1927- 28.	1928- 29.	1929- 30.	1930- 31.	1931- 32.	1932- 33.	1933- 34.	1934- 35.
Spinning Test Reports .. ..	7	10	10	22	21	63	92	60	87	121	112
Fibre Test Reports .. ..	1	1	5	1	7	4	7	19	30	18	19
Yarn Test Reports .. ..	..	..	..	1	4	4	2	3	5	3	7
Total Reports .. ..	8	20	24	24	32	71	101	82	122	142	138

It will be seen that as compared with the last year more fibre test and yarn test reports were issued while the number of spinning test reports was somewhat less. The total number of reports issued during the period under review is slightly less than that of last year as fewer samples could be spun owing to the work involved in the extension of the Laboratory.

The strength of the permanent staff employed at the Laboratory from year to year since 1924 is given in the following table :—

As at August 31st in :	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935
Technical Staff .. ..	8	11	20	21	27	27	32	32	32	33	34	34
Research Students ..	1	3	6	4	3	2	1	1	..	..	..	..
Fumigation Chemists ..	..	..	2	4	2	2	2	2	2	2	2	2
Total .. ..	9	14	28	32	32	31	35	35	34	35	36	36

It may be mentioned here that in view of the large number of samples received for tests it was found necessary to employ two temporary Junior Testers for a period of four months each.

#### CLASSIFICATION OF SAMPLES.

The samples received for tests at the Technological Laboratory fall into the following four classes :—

- (a) Agricultural samples.
- (b) Standard Indian cottons.
- (c) Trade samples.
- (d) Technological samples.

We shall now describe briefly the work done under these four heads

(a) *Agricultural samples*—These samples are received from the cotton breeders and agricultural officers who are engaged in the work of improving the quality of cotton in the provinces. They mostly represent strains which are as yet in the experimental stage, but many samples are sent in connection with the field experiments undertaken by the Department of Agriculture on such problems as the effect of differential irrigation, effect of rotation of crops, effect of date of sowing, etc. Among these samples the following are worthy of special mention

(1) *Effect of differential irrigation upon the fibre properties and spinning quality of cotton*—These tests have been in progress at the Laboratory for some time past and at the February 1935 meeting of the Indian Central Cotton Committee a report containing the available results was presented. This report was very carefully considered by the Technological Research Sub Committee and it was decided that as this investigation had yielded interesting results it should be continued and that the results so far available should be published. In the current year samples for this purpose have been received from Lyallpur, Coimbatore Sakrand Ganganagar and Padegaon

(2) *Uganda cottons*—It will be remembered that for the last three years the Technological Laboratory has made tests on samples of improved variety of Uganda cottons, submitted by the Department of Agriculture, Uganda Protectorate. This year 8 samples were received for this purpose and a copy of the spinning test report which was sent to the Department of Agriculture Uganda was also placed before the Technological Research Sub Committee. The Department of Agriculture Uganda, expressed its appreciation of the help given by the Laboratory and requested that in the next year facilities may be provided for testing 16 instead of 8 samples. This request was considered by the Technological Research Sub Committee at its meeting held in August 1935 and it was decided that, as in the past 8 samples may be tested free of charge but that for any additional samples the usual fees should be charged.

(3) *Tests on 38F and 43F*—These two strains are further selections from Punjab American cotton and have been under trial at Lyallpur for some years past. Having given very satisfactory results on the farm, it was decided to try them out in the cultivators' fields in order to see which of these two strains would be more suitable for general cultivation. Accordingly, about 20 samples of these two strains were received and tested at the Laboratory and reports embodying the results of fibre tests and spinning performance were sent to the Department of Agriculture Punjab.

(4) *Tests on Boss III and Sea Island*—These are two long staple cottons which are under trial in the new Barrage area in Sind. During the past six years that they have been tested at this Laboratory, they have given very satisfactory results and yarns ranging from 60 s to 80 s of satisfactory evenness have been spun from them. As it is possible that the cultivation of these cottons may be extended in the near future, rather more detailed tests which

included the spinning of carded and combed yarns were made on them in the current year. For purposes of comparison a sample of Egyptian Giza 7 was obtained and treated in the same manner and the results for the Sind cottons were compared with those obtained for Giza 7. A report containing the results of these experiments was sent to the Agricultural Department, Sind.

(b) *Standard cottons*.—As in the past detailed spinning and fibre tests were made on the standard Indian cottons of the last season. These cottons represent certain improved varieties, which are now being grown to the extent of 15 per cent. of the total area under cotton cultivation in India. This year four new varieties were included among the standard Indian cottons. Two of these came from Sind, where, as a result of the development of the Sukkur Barrage, the area under cotton cultivation is increasing at a considerable rate. These two cottons have been named "Sind Sudhar" and "Sind N. R." The former is an improved type of Sind-American and represents the long staple cotton which will be extended in Sind in the future. The latter is a selection from the Sind-Desi type, which has been selected for general cultivation in Sind on the basis of its stand in the field, yield, ginning percentage and colour. The other two new standard cottons are further selections of C. P. Verum 262 and are named "V. 434" and "Late Verum". The former is specially suited to areas where the rainfall is irregular, while the latter is specially suited to areas in which the monsoon is likely to continue late in the season. These cottons have been tested in the past at the Technological Laboratory and besides possessing the above mentioned advantages have given, on the whole, even better results than Verum 262.

As most of the standard cottons are now grown on a commercial scale and are available in the market, the results of fibre tests and spinning tests are published in the form of 4-page circulars soon after their receipt at the Laboratory. During the year under review 4-page circulars were published on the following nine cottons :—

1. Umri Bani.
2. Verum 262 (Nagpur).
3. Verum 262 (Akola).
4. Punjab-American 289F.
5. Punjab-American 4 F.
6. Jayawant (Kumpta).
7. Surat 1027 A.L.F.
8. Gadag 1 (Dharwar-American).
9. Cambodia Co. 2.

(c) *Trade samples*.—(1) As in the past spinning tests were made on samples of trade varieties which form the bulk of the Indian cotton crop. These samples are tested in accordance with the arrangements between the

Indian Central Cotton Committee on the one hand and the East India Cotton Association Bombay, and the Millowners Associations of Bombay and Ahmedabad on the other. The cotton samples supplied by the East India Cotton Association under this arrangement are of fair average quality for the season while those supplied by a number of mills through their Associations are of the early arrivals of the crop. The object of these tests is to supply first hand information to the trade and the industry regarding the waste losses and the spinning quality of these cottons. The results of these tests are published in the form of 2-3 page circulars, which contain not only the results of the current season's tests but also of those carried out on the same variety in the previous seasons. Thus, these circulars not only furnish information regarding the performance of these cottons in the current season, but they also enable one to find out whether a given variety is maintaining its quality or is showing signs of deterioration. In view of the practical value of these tests it has been decided to publish these circulars collectively in the form of a bulletin. The following statement gives the description of trade samples tested during the period under review.

*Cottons supplied by the East India Cotton Association —*

1	C P No 1	14	Westerns (Jhaveria)
2	Berar	15	Farm Westerns
3	Khandesh	16	Coompta
4	Nanded	17	Upland (Gadag)
5	Lattur	18	Bijapur
6	Muttia	19	Bagalkote
7	Punjab American	20	Cambodias
8	Broach	21	Tinnevely
9	Jagadia Farm	22	Karungannis
10	Surat	23	A R Kampala
11	Navsari	24	A R Busoga
12	Dholleras (Wagadia)	25	A R Jinja
13	Kalagin		

*Cottons received in accordance with the arrangement made with the Millowners Associations of Bombay and Ahmedabad*

BOMBAY

1	Hansi (Bengal)	11	Shedbal (Miraj)
2	Saudha (Khandesh)	12	Farm Westerns
3	Ujjain (Central India)	13	Broach
4	Padtur (Moglai)	14	Bailhongal
5	Mandsaur (Ujjain)	15	Tiruppur Cambodia
6	Hubli Coompta	16	Karunganni
7	Hubli Upland	17	Nandyal
8	Surat	18	Northern Cambodia
9	Cambodia	19	A R Kampala
10	Guntakal (Westerns)	20	A R Busoga

## AHMEDABAD.

Nil.

A list of the Technological Circulars issued on these samples will be found under "Publications."

In addition to these tests, of which the results are published for general information, the Laboratory also undertakes tests on samples supplied by mills and firms in their private capacity. During the year under review 39 such samples were received and reported upon. Of these, 14 samples were received for spinning tests, 8 for fibre tests, 12 for yarn tests, 2 for determination of wax content, one for fibre maturity and two for determination of blow-room loss. These tests are undertaken on payment of certain fees laid down by the Indian Central Cotton Committee which are reproduced below :

## SCALE OF FEES.

					Rs.	a.	p.
(1)	Fibre or Yarn Test—						
(a)	Mean fibre-length	..	..	..	7	8	0
(b)	Fibre-weight per inch	..	..	..	7	8	0
(c)	Fibre-strength	..	..	..	10	0	0
(d)	Lea Test	..	..	..	7	8	0
(e)	Ballistic Test	..	..	..	7	8	0
(f)	Single Thread Test	..	..	..	7	8	0
(g)	Twist	..	..	..	7	8	0
(2)	Fibre and Blow-room Test—						
(a)	Fibre tests—As for (a)—(c) above	..	..	..			
(b)	Blow-room only	..	..	..	10	0	0
(3)	Full Test—						
(a)	Fibre tests—As for (a)—(c) above	..	..	..			
(b)	Spinning test only	..	..	..	35	0	0
(c)	„ „ on combed cotton	..	..	..	50	0	0
(4)	Variety of cotton (broad classification)	..	..	..	25	0	0
(5)	Identification of fibre (microscopic test)	..	..	..	15	0	0
(6)	Percentage of size	..	..	..	7	8	0
(7)	„ of grease	..	..	..	7	8	0
(8)	„ of free acid	..	..	..	15	0	0
(9)	Presence of mildew	..	..	..	7	8	0
(10)	Causes of mildew growth	..	..	..	30	0	0

						Rs. a. p.
(11)	Percentage of immature fibres—					
	(a) In lint or kapas	..	..	..	10	0 0
	(b) In yarn or cloth	..	..	..	15	0 0
(12)	Wax content—					
	(a) 1 Sample	..	..	..	12	8 0
	(b) 2 Samples	..	..	..	22	8 0
	(c) 3 Samples	..	..	..	30	0 0
	(d) Each additional sample	..	..	..	7	8 0
(13)	Determination of mechanical injury to fibre.				10	0 0
(14)	Tests in addition to the ordinary roller system	..	..	..	10	0 0 per system.
(15)	Cloth Samples—					
	(a) Actual counts	..	..	..	15	0 0
	(b) Actual twist	..	..	..	20	0 0
	(c) Single thread strength	..	..	..	20	0 0
(16)	Moisture Tests—					
	(a) 1 Sample	..	..	..	5	0 0
	(b) 2 Samples	..	..	..	7	8 0
	(c) 3 Samples	..	..	..	10	0 0
	(d) 4 Samples	..	..	..	12	8 0

(2) *African cottons.*—It will be recalled that during the last three years the Laboratory had undertaken fibre tests on samples of fair average quality of A. R. Kampala, A. R. Busoga and A. R. Jinja with a view to helping the East India Cotton Association to lay down standards of length for these cottons. During the period under review the final report on these cottons, comprising the results for 75 samples, was sent to the East India Cotton Association. It was considered in June last by their Special Appeal Committee on African cottons, who made their recommendation regarding the standards of length for these cottons to the Board of the Association on the basis of this report.

(3) *Effect of artificial watering on the spinning quality of cotton.*—These tests have been in progress for some time with the object of finding out the effect on spinning quality of the addition of a known quantity of water to cotton before it is pressed into a bale. For this purpose, the two cottons selected were Amraoti and Broach (Palej) and for each cotton a number of bales containing different quantities of water added to them before pressing were prepared, samples were drawn from these bales from time to time and subjected to fibre and spinning tests. During the period under review the results for the

Amraoti bales were placed before the Technological Research Sub-Committee at its meeting held in February 1935 and it was decided that when the results of the Broach (Palej) cotton are also available these should be published.

(4) *The effect of different degrees of compression on the spinning quality of cotton.*—It was originally the intention to make tests on two cottons, namely, Superfine Oomra and Punjab-American 289F, with a view to finding out whether, and to what extent, the spinning quality of cotton is affected by the degree of compression in a bale. The tests, however, could only be made on Superfine Oomra and the results of these tests were considered by the Technological Research Sub-Committee in February last. It was felt that the effect of compression if any would be more pronounced in the case of the comparatively long staple cottons. It was accordingly decided that these tests should be performed on Punjab-American 289F, Surat 1027 A.L.F., Jayawant, and Cambodia. Bales pressed to the same size but weighing nearly 400, 300 and 200 lb. of the four above-mentioned cottons have been purchased and the necessary tests will be made in due course.

(5) *Deterioration of cotton stored in the open and in shed at Karachi.*—During the period under review this investigation was also completed and a report containing the results and the main conclusions was placed before the Technological Research Sub-Committee at its meeting held in August last. The Committee decided that the results were highly interesting and that as they showed that cotton stacked in the thole yard definitely suffered both in grade and spinning performance, a copy of the report should be sent to the Karachi Cotton Association with the recommendation that they should request the Karachi Port Trust to provide more godown facilities at Karachi.

(d) *Technological Samples.*—

(1) *Limit spinning tests.*—In order to study the effect of insertion of twist on the strength, evenness and appearance of yarns an investigation has been undertaken with two cottons, namely, Superfine Oomra and Punjab-American 4F which were spun into suitable counts with different twist multipliers ranging from  $3\frac{3}{4}$  to  $5\frac{1}{2}$ . This investigation is in progress.

(2) *High Draft tests.*—The Laboratory has already issued two Bulletins on the results of application of high draft spinning to Indian cottons. Since the publication of the last Bulletin some more systems of high draft spinning have been acquired by the Laboratory and accordingly another investigation has been undertaken in order to extend the scope of the former work. For this purpose mixings of two Indian cottons have been spun on five systems of high draft spinning in addition to the ordinary system. This investigation is in progress.

(3) *Effect of balanced and unbalanced drafts on mixings.*—For the purpose of this investigation mixings were made, in different proportions from P.A. 289F with P.A. 4F, Mollisoni with P.A. 4F and Kampala with P.A. 4F. Suitable



hank rovings prepared from these mixings were spun with balanced and unbalanced drafts into identical counts and the yarns were examined for strength, evenness, elasticity, etc. This investigation was completed during the period under review and an account of it will be published in the form of a Technological Bulletin.

(4) *Effect of storage of seed-cotton prior to ginning*—During the period under review this investigation was completed and the results were published in a Technological Bulletin a summary of which will be found on page 64. The Technological Research Sub Committee, while considering the report of the work on this subject, decided that these tests may also be performed on Wajad 8 and Punjab-American cottons with the storage period increased to about 4 months.

(5) *Combing of good quality Indian cottons*—It was stated in one of my previous Annual Reports that an investigation was undertaken at the Technological Laboratory to find out the limit spinning performance of four good quality Indian cottons when these had been combed to the extent of 20 per cent, and 30 per cent. Alongside of the spinning of fine counts from the combed cottons both on the ordinary system and a high draft system, the comber wastes obtained from these cottons were mixed with low quality cottons and were spun into relatively coarse counts. During the period under review an account of this investigation was written up and published in the form of a Technological Bulletin, a summary of which will be found under "Publications".

(6) *Comparative tests on the effect of change in the blow room machinery*—It has been mentioned above that during the period under review the blow room plant of the Laboratory was overhauled, some old machines were discarded and new machines were installed. As one of the primary functions of the Laboratory is to undertake tests on agricultural samples from season to season, it is necessary to have information regarding the effect on the spinning performance of any change introduced in the processing plant. For this purpose 8 varieties, covering the full range of staple length of Indian cottons were selected and were processed both on the old and the new plant. The results of yarn tests on these samples when available will yield the necessary correction factor, if any, which should be applied as a result of the alteration in the blow room plant.

## II RESEARCH LABORATORY

*Fibre Testing Section*—It is customary at the Laboratory to determine the principal fibre properties of all the agricultural samples on which spinning tests are carried out. Besides this, fibre tests are also made on the standard Indian cottons as well as on the samples which are tested at the Laboratory in connection with its technological investigations. All these tests which normally involve the determination of mean fibre-length and fibre weight per inch and in some cases that of fibre strength and fibre maturity of cotton, are

carried out in the Fibre Testing Section, which, as a result, was kept fully occupied with these tests. In addition to these comparatively large sized samples, the Laboratory receives a number of small size samples of strains which are as yet in the early stage of experimentation and on which fibre tests are required by the breeders. During the period under review, 95 such samples were received for fibre tests out of which 17 came from the Cotton Research Botanist, Parbhani and 16 from the Senior Assistant Botanist, Mysore State, Bangalore. With the other work involved in making fibre tests on the large sized samples, it was possible to make the fibre tests on only 59 of these small size samples. The following statement gives a description of such samples on which fibre tests were completed during the period under review:—

1. *The East India Cotton Association Ltd., Bombay.*—Fifteen samples of A. R. Kampala, Busoga and Jinja cottons ; one sample of Punjab-American and 2 other samples.
2. *The Cotton Breeder, S. M. C., Dharwar.*—Three samples of cross strains.
3. *The Cotton Breeder, Government Farm, Broach.*—Two cross strains.
4. *Botanist in Sind, Sakrand.*—Four samples of cross strains.
5. *Messrs. Narandas Rajaram & Co., Bombay.*—Two samples of Dabhoi Farm cotton.
6. *The Senior Assistant Botanist, Mysore State, Bangalore.*—Sixteen samples of *Nadam Cernuum* and other cross strains.
7. *The Meyer Sassoon Mills Co., Ltd., Bombay.*—One sample of Amod cotton.
8. *The Director, Institute of Plant Industry, Indore.*—Eight samples of Malvi selections of different growths and picking.
9. *F. D. Nanavati, Esq., Bombay.*—Two samples of Punjab-American cottons.
10. *Messrs. P. Chrystal & Co., Bombay.*—One sample of P. A. 4F and two other samples.

*Mr. Hari Rao Navkal*, in addition to supervising the work of this Section, has continued his investigation on the effect of twist on the strength and extension of cotton fibre. Mr. Hari Rao has now completed these tests on five cottons covering the short, medium and long staple varieties. As it was felt that sufficient experimental work has been done in connection with this investigation, Mr. Hari Rao is now engaged in analysing the results with a view to publishing them in the near future in the form of a Technological Bulletin.

*Physics Section*—Mr R S Koshal continued the analysis of the effect of distribution of rainfall and temperature on the fibre properties and the spinning value of a cotton. For this purpose he has utilised the results of detailed tests carried out at the Laboratory on the standard Indian cottons during the last 10 seasons. Information regarding rainfall and temperature was solicited from the suppliers of the samples and Mr Koshal has already obtained extremely interesting results. It has been found for instance, that in cottons like C A 9 and P A 4F in which large differences were observed in some seasons between the values of the predicted and the actual highest standard warp counts, the inclusion of the rainfall factor brought about a much closer agreement. Mr Koshal further analysed the results for the three Madras cottons, namely, Nandyal 14, Karunganni C 7 and Hagari 1 and found that if the rainfall factor were also taken into consideration in addition to length and fibre weight per inch only a very few cases showed a large disparity between the actual and the predicted values. Mr Koshal is continuing this investigation with respect to the other cottons for which the necessary data is available. Besides doing this work Mr Koshal is also at present devoting a part of his time to a study of the strength of bundles of cotton fibre. This work is in progress.

Mr C Nanjundayya continued his investigation of the rate of absorption of moisture by short, medium and long staple cottons at different humidities. In order to carry out this investigation an apparatus has been designed at the Laboratory which makes it possible to maintain automatically any humidity between 30 per cent and 80 per cent R H for any length of time. This apparatus will also be found useful in other investigations of a similar type where it is proposed to keep the cotton fibre or yarn at any desired humidity for any period of time. In addition to this work Mr Nanjundayya has undertaken an investigation on the properties of cotton fibre at the point of rupture of yarn.

Dr K R Sen who joined the staff of the Laboratory on 17th May 1935 has undertaken an investigation on the effect of fibre properties of cotton on their 'mixing' quality. Hitherto the Laboratory has concentrated its investigations on the effect of fibre properties on the spinning value of a cotton. In actual practice, however, as is well known, cottons are rarely used in pure form in the mills where most of the *spinnings* are made from *mixings* of two or more varieties. It is therefore important, from a practical as well as a theoretical point of view, to determine what fibre properties are important from the point of view of the 'mixing' quality of two cottons. For this purpose, fibre tests will be made on a series of cottons which will be mixed in different proportions and parallel spinning tests on these mixings will also be undertaken.

*Chemistry Section*—Mr D L Sen completed the determination of the wax content of standard Indian cottons which was undertaken to throw light on the differential absorption of dyes by these cottons. Following this work, Mr Sen continued the study of the differential absorption of different dyes by a number of Indian cottons. He has so far examined the absorption of two dyes by all the standard cottons and of another four dyes by six of these cottons. Besides doing this work, he carried out moisture tests on 26 samples of which an account will be given later.

*Microscopy Section.*—*Mr. A. N. Gulati.*—It was stated in one of the previous Annual Reports that an investigation was undertaken at this Laboratory in order to study the relationship between the fibre-maturity and the degree of yarn neppiness of a cotton. For this purpose a large number of cottons were selected and were examined for the percentage of mature, half-mature and immature hairs. During the period under review an account of this investigation was published in a Technological Bulletin, a summary of which will be found under "Publications". Mr. Gulati also continued his investigation on the bacterial and fungoid growth in connection with the deterioration of Broach cotton. For this purpose, he prepared cultures in special media of the various micro-organisms which were found associated with this cotton and was successful in isolating and identifying most of them. Arising from the examination of the Broach cotton stored for nearly a year, he observed a new type of bacterial infection of which no mention appears to have been made by any of the earlier workers on this subject. In this type of infection the bacteria, instead of merely puncturing the walls of the fibre, were found to feed upon the secondary cellulose, working their way gradually along the length of the fibre. Mr. Gulati took several photographs showing this type of bacterial infection and an account of these observations has been sent for publication in the Indian Journal of Agricultural Science. It should also be stated that, in addition to the above work, Mr. Gulati examined numerous samples for fibre-maturity in connection with the routine work of the Laboratory. It is now proposed to hand over the fibre maturity work to the Fibre Testing Section as a part of their normal activity.

*Dr. L. Thoria* joined the staff of the Laboratory on 1st May 1935. He began work on the possibility of the utilisation of the short staple cottons for the manufacture of artificial silk and staple fibre. For this purpose, Dr. Thoria prepared secondary acetates from samples of cheap short staple Indian cottons, wastes and rags, etc. Films of suitable thickness were prepared from these acetates and their strength and elasticity were determined. These will be compared with films made from other materials.

### III. MOISTURE TESTING SECTION.

In view of the fact that in the last three years sufficient data has been collected with regard to the average moisture content of Indian cottons received in Bombay at different times of the year and its variation in the dry and the wet season, only 26 samples were subjected for moisture tests during the period under review. These samples included 7 from the Appeal Committee of the East India Cotton Association, 4 from trade bales and 15 in connection with the Laboratory investigations. The total number of samples so far tested in this Section now amounts to 747, out of which 390 were drawn either from the trade bales or supplied by the Appeal Committee of the East India Cotton Association. Since it was felt that the available results constitute adequate basis for drawing reliable conclusions a final report containing the results of all the tests on samples either drawn from trade bales or supplied by the

Appeal Committee of the East India Cotton Association, was written up during the period under review. This report was considered by the Moisture Tests Sub Committee of the Association who made their recommendations for standards of moisture to the Board of the Association

#### IV PUBLICATIONS

The following is a list of Technological Bulletins and Circulars issued during the period under review —

##### I Technological Bulletins, Series A, Nos 26 and 27

- (1) Technological Bulletin, Series A, No 26 "Technological Reports on Standard Indian Cottons, 1934" by Nazir Ahmad, M Sc, Ph D, F Inst P
- (2) Technological Bulletin, Series A, No 27 "Combing of Good Quality Indian Cottons" by R P Richardson, F T I, and Nazir Ahmad, M Sc, Ph D, F Inst P

##### II. Technological Bulletins, Series B, Nos 19 and 20

- (1) Technological Bulletin, Series B, No 19 'Effect of Storage Prior to Ginning on the Spinning Quality of Cotton' by Nazir Ahmad, M Sc, Ph D, F Inst P
- (2) Technological Bulletin, Series B, No 20 "Fibre Maturity in Relation to Fibre and Yarn Characteristics of Indian Cottons" by Amar Nath Gulati, M Sc, and Nazir Ahmad, M Sc, Ph D, F Inst P

##### III Technological Circulars Nos 150 to 195, as under —

Circular No	Title	Date of publication
150	Spinning Test Report (No 514) on samples of A R Kampala A R. Busoga and A R Jinja cottons 1933 34	September 1934
151	Spinning Test Report (No 515) on samples of Bijapur cotton, 1933 34	September 1934
152	Spinning Test Report (No 516) on samples of Upland cotton 1933 34	September 1934
153	Spinning Test Report (No 517) on samples of Karun ganm cotton 1933 34	September 1934
154	Technological Report on Verum 262 (Nagpur) 1934 35	December 1934
155	Technological Report on Verum 262 (Akola) 1934 35	December 1934
156	Technological Report on Umri Bani, 1934 35	January 1935
157	Technological Report on Punjab American 289F 1934 35	January 1935
158	Spinning Test Report (No 559) on samples of C P No 1 cotton 1934 35	February 1935

Circular No.	Title.	Date of publication.
159	Spinning Test Report (No. 560) on samples of Berar cotton, 1934-35 .. .. .	February 1935.
160	Spinning Test Report (No. 561) on samples of Khandesh cotton, 1934-1935 .. .. .	February 1935.
161	Spinning Test Report (No. 566) on samples of Khandesh cotton, 1934-35 .. .. .	February 1935.
162	Spinning Test Report (No. 567) on samples of Moglai cotton, 1934-35 .. .. .	February 1935.
163	Spinning Test Report (No. 568) on samples of Bengals cotton, 1934-35 .. .. .	February 1935.
164	Spinning Test Report (No. 570) on samples of Ujjain (Ujjain) cotton, 1934-35 .. .. .	February 1935.
165	Spinning Test Report (No. 571) on samples of Ujjain (Mandsaur) cotton, 1934-35 .. .. .	February 1935.
166	Spinning Test Report (No. 577) on samples of Hubli Kumpta cotton, 1934-35 .. .. .	March 1935.
167	Technological Report on Gadag 1 (Dharwar-American) 1934-35 .. .. .	April 1935.
168	Spinning Test Report (No. 582) on samples of Latur cotton, 1934-35 .. .. .	April 1935.
169	Spinning Test Report (No. 583) on samples of Nanded cotton, 1934-35 .. .. .	April 1935,
170	Spinning Test Report (No. 584) on samples of Muttia cotton, 1934-35 .. .. .	April 1935.
171	Spinning Test Report (No. 591) on samples of Broach cotton, 1934-35 .. .. .	June 1935.
172	Spinning Test Report (No. 592) on samples of Jagadia cotton, 1934-35 .. .. .	June 1935.
173	Spinning Test Report (No. 593) on samples of Punjab-American cotton, 1934-35 .. .. .	June 1935.
174	Spinning Test Report (No. 595) on samples of Bailhongal cotton, 1934-35 .. .. .	June 1935
175	Spinning Test Report (No. 596) on samples of Broach cotton, 1934-35 .. .. .	June 1935.
176	Spinning Test Report (No. 597) on samples of Karunganni cotton, 1934-35 .. .. .	June 1935.
177	Spinning Test Report (No. 598) on samples of Tiruppur Cambodia cotton, 1934-35 .. .. .	June 1935.
178	Spinning Test Report (No. 599) on samples of Northern Cambodia cotton, 1934-35 .. .. .	June 1935.
179	Spinning Test Report (No. 600) on samples of Farm Westerns cotton, 1934-35 .. .. .	June 1935.
180	Spinning Test Report (No. 601) on samples of Westerns cotton, 1934-35 .. .. .	June 1935.
181	Spinning Test Report (No. 602) on samples of Miraj cotton, 1934-35 .. .. .	June 1935.
182	Spinning Test Report (No. 603) on samples of Nandyal cotton, 1934-35 .. .. .	June 1935.
183	Spinning Test Report (No. 604) on samples of Surat cotton, 1934-35 .. .. .	July 1935.
184	Spinning Test Report (No. 606) on samples of Tiruppur Cambodia cotton, 1934-35 .. .. .	July 1935.
185	Spinning Test Report (No. 607) on samples of African Busoga cotton, 1934-35 .. .. .	July 1935.

Circular No.	Title.	Date of publication.
186	Spinning Test Report (No. 608) on samples of Kampala cotton, 1934-35 .. .. .	July 1935.
187	Spinning Test Report (No. 609) on samples of Hubli Upland cotton, 1934-35 .. .. .	July 1935.
188	Technological Report on Punjab-American 4F, 1934-35. .. .. .	July 1935.
189	Technological Report on Surat 1027 A.L.F., 1934-35 .. .. .	July 1935.
190	Spinning Test Report (No. 612) on samples of Kalagin cotton, 1934-35 .. .. .	July 1935.
191	Spinning Test Report (No. 613) on samples of Farm Westerns cotton, 1934-35 .. .. .	July 1935.
192	Technological Report on Jayawant (Kumpta) cotton, 1934-35 .. .. .	August 1935.
193	Technological Report on Cambodia Co.2 (Cambodia 440), 1934-35 .. .. .	August 1935.
194	Spinning Test Report (No. 620) on samples of Navsari cotton, 1934-35 .. .. .	August 1935.
195	Spinning Test Report (No. 621) on samples of Upland cotton, 1934-35 .. .. .	August 1935.

The following is a summary of *Technological Bulletins, Series A, No. 27 and Series B, Nos. 19 and 20* :—

(1) *Technological Bulletin, Series A, No. 27 "Combing of good-quality Indian Cottons"*.—The present bulletin describes the results of combing tests carried on four good quality Indian cottons, namely, P.A. 289F, Cambodia Co. 1, Nandyal 14 and Surat 1027 A.L.F. These cottons were combed on a Nasmyth Comber to the extent of 20 per cent. and 30 per cent. (27 per cent. in the case of 1027 A.L.F. for the higher degree of combing). The resulting slivers were spun on the ordinary and a high draft system of spinning into counts much finer than those permissible for the carded material. The comber wastes in each case were mixed, in the proportion of 1 : 3 with a low quality cotton grown in the same province and the good quality cottons and the mixtures thus obtained were spun into suitable counts on the ordinary system. The behaviour of each sample during spinning was noted and the yarns obtained were examined for evenness, neppiness and strength. In the course of this investigation 103 different spinnings were carried out, giving rise to 1,004 bobbins for tests. The number oflea tests performed amounted to 4,957, that of ballistic tests 4,870 and that of single thread tests 10,040, making a grand total of 19,867 tests for yarn strength alone. Besides these, the low quality cottons, the comber wastes and the carded and the combed slivers of the good quality cottons were subjected to fibre tests for the determination of mean fibre-length, fibre-length irregularity and fibre-weight per inch. From a consideration of the results of all these tests the following conclusions are arrived at :—

1. The mean fibre-length of the combed material, for each of the four cottons, was either equal to or only slightly higher than that of the carded

material. The process of combing, therefore, even to the extent of 30 per cent. did not bring about a large increase in the mean fibre-length of any of these cottons.

2. The process of combing, on the other hand, was remarkably effective in reducing the fibre-length irregularity of these cottons. The improvement in this direction was most pronounced in the case of the cotton (P.A. 289F) which had the highest value of fibre-length irregularity. Thus, the combed cottons were only slightly longer but much more regular in length than the carded cottons.

3. The 20 per cent. comber waste was found, in each case, to be about 15 per cent. shorter than the cotton from which it was extracted. Its fibre-length irregularity percentage was, however, independent of the cotton, being nearly 24 in each case. The 30 per cent. comber wastes, were, on the whole, somewhat longer and less irregular in length than the 20 per cent. comber wastes, but, unlike the latter, their mean fibre-length did not bear any straightforward relationship to that of the cotton, nor their fibre-length irregularity was confined to a narrow range.

4. The hair weight per inch of the comber wastes was either very nearly equal to, or a little higher than that of the carded material depending upon the botanical variety of the cotton.

5. Yarn breakages on the ring frame were, on the whole, less on the high draft than on the ordinary system thus making it possible to spin within the economic limit finer counts on the former system.

6. The process of combing considerably reduces, though does not completely eliminate, neppiness in cottons in general and is most effective in the case of such cottons as P.A. 289F which ordinarily give rise to neppy yarns.

7. When the low quality cottons were mixed with the comber wastes, the yarns obtained from the mixtures were in each case more neppy than those spun from pure cottons, though in no case were they so neppy as to be unserviceable. Besides the neppiness content of a cotton and a comber waste, other factors, such as the capacity of the two to mix together, operate in determining the neppiness of the yarns obtained from the mixture.

8. The system of spinning, ordinary or high draft, made no difference to the degree of neppiness of the yarns.

9. Though the yarns spun from the combed cottons were much finer than those obtained from the carded cottons, they were, on the whole, quite satisfactory from the point of evenness.

10. The high draft system gave more even yarns than the ordinary system, the improvement in this respect being more marked in the carded than in the combed yarns.



11. The effect of a comber waste in determining the evenness class of yarns spun from its mixture with a pure cotton depends upon the spinning quality of the former as compared to that of the latter. Where the two are very nearly equal, the yarns spun from the mixture are just as even as, or only very slightly less even than, those obtained from the pure cotton. Where, on the other hand, the waste is of a definitely poorer quality than the pure cotton, the yarns obtained from the mixture are appreciably less even than those spun from the pure cotton.

12. Combing to the extent of 20 per cent made a very considerable improvement in the spinning quality of each of these cottons so that it was possible to spin 50's and 60's yarns from cottons which are ordinarily regarded as suitable for spinning up to a maximum of 30 s warp. The response to the combing treatment, however, was different for the different cottons, and it was found that for these four cottons at least the percentage improvement in spinning quality followed the order of the mean fibre-length of the cottons.

13. In practically all cases the high draft system yielded stronger yarns than the ordinary system, the increase in strength however, was more pronounced in the case of some cottons than in that of others. It was also more marked in the finer than in the relatively coarser counts.

14. In the case of three cottons the beneficial effects of (1) combing to the extent of 20 per cent and (2) spinning on the high draft system were found to be additive, while in the fourth case in which the effect of the 20 per cent combing alone was very large, it was not the case.

15. Whereas combing to the extent of 20 per cent raised the capacity of these cottons to spin into finer counts by a very considerable amount, combing to the extent of 30 per cent did not in all cases confer a benefit commensurate with the additional loss of 10 per cent fibres. The use of the higher degree of combing may not, therefore, prove an economic proposition in every case. As to when combing should be advantageously pushed up to 30 per cent and when it should be left at 20 per cent depends upon the system of spinning employed and the variety of cotton under test. In connection with the latter point, it was found that if 20 per cent combing produced very large improvement in the spinning quality of a cotton combing to the extent of 30 per cent did not appreciably raise its spinning performance. If, on the other hand, the initial improvement resulting from 20 per cent combing is not so large, there is room for further improvement in spinning quality by extracting 30 per cent fibres.

16. 20 per cent combed cottons spun on the high draft system gave very nearly the same results as those obtained for the 30 per cent combed cotton spun on the ordinary system. Thus, where the high draft system used in these tests is or can be made available, it would be more economical to comb the cotton only to the extent of 20 per cent and employ the high draft system in their spinning rather than push the combing to 30 per cent and use the ordinary system.

17. The main causes for the very considerable improvement in the spinning value of a cotton consequent upon combing must be sought in factors other than a mere increase in mean fibre-length, these factors being primarily a more regular disposition and greater length uniformity of the fibres in the combed material.

18. Employing a special technique no difficulty was experienced in obtaining yarns from mixtures of comber wastes and low quality cottons. In the case of three cottons the yarns spun from the mixtures were somewhat weaker than those given by the pure cottons, showing that comber waste was poor in spinning quality than the pure cotton. In the fourth case the yarns spun from the mixtures were just as strong as those obtained from the pure cottons.

19. Only in the case of one cotton—P.A. 289F—the yarn strength results of the 30 per cent. comber waste mixture were definitely better than those for the 20 per cent. waste mixture. In the case of the other three cottons the differences in yarn strength between the two waste mixtures were generally not large.

(2) *Technological Bulletin, Series B, No. 19, "Effect of storage prior to ginning on the spinning quality of cotton.*—The object of this paper is to describe the results of an experiment carried out specifically with the object of ascertaining the influence of storage of seed-cotton upon the fibre-properties and spinning quality of cotton. No attempt was made to determine the damage done to the fibres by bacterial and fungoid growths, as this part of the ground has already been traversed by other workers. The three cottons selected for these experiments are improved varieties grown in the Punjab and are called Punjab-American 289F, Punjab-American 4F and Mollisoni.

It was found that storage of cotton in seed for four weeks before ginning has no effect whatever either upon its mean fibre-length or fibre-weight per inch. The results of these tests, thus, do no support the view that the development of the cotton fibre continues after picking during the period of storage of seed-cotton. Similarly, the other view that during storage oil diffuses from the seed into the fibre is not confirmed by the results of wax determination. Only in the case of one cotton, P.A. 289F, the wax content of the stored sample was found to be significantly higher than that of the early-ginned sample. As against this, P.A. 4F gave just the opposite result, the wax percentage of the stored sample being actually *less* than that of the sample ginned immediately after picking, while the difference between the values of wax content for the two types of samples of the third cotton, Mollisoni, was negligible.

The results of the spinning test show that the yarns spun from the sample of P.A. 289F, which was stored before ginning for four weeks, were stronger and more even than those given by the early ginned sample of the same cotton. This feature, again, was not shared by the other two cottons which gave similar results for the two types of samples except in 6'sA counts of one cotton—Mollisoni—where the stored sample had the advantage.

Thus, in the case of two cottons, storage of seed-cotton before ginning did not bring about any improvement whatever in fibre-properties, wax content or spinning performance, while it held the possibility of severe loss due to bacterial deterioration. In the case of one cotton only a small improvement in wax content and spinning performance was observed, but it would be rash to regard it as an argument in favour of delaying the ginning operation and to ignore the harmful effects of storage upon the quality of the seed and lint. If, by force of circumstances, it may become necessary to store the seed-cotton for a while before ginning, every precaution should be taken to ensure that the sample is dry, that it does not contain large quantities of dirt or trash and that the atmosphere in the store-room is neither particularly warm nor humid. If the period of storage should exceed a few weeks, the seed-cotton should be occasionally taken out and exposed to sun.

(3) *Technological Bulletin, Series B, No. 20, "Fibre Maturity in Relation to Fibre and Yarn characteristics of Indian cottons.*—The present report contains an account of an investigation undertaken with the object of determining the effect of season, locality of growth, heredity, etc., on the fibre-maturity of Indian cottons, the relationship of the latter with the mean-length, fibre-weight per inch and fibre-strength of these cottons and its influence on the neppiness and strength of the yarns spun from them.

The technique employed in these tests is described in detail. The following conclusions are drawn from an analysis of the observed data :—

(1) Different cottons behave differently in regard to the effect of season on fibre-maturity ; in some the maturity is subject to seasonal fluctuation, in others the season has very little effect.

(2) The locality of cultivation has a pronounced effect on the degree of fibre-maturity of Banilla cotton.

(3) Selections from the same common parents grown under similar conditions may differ significantly in regard to fibre-maturity.

(4) The saw-gin does not exercise any selective action on the immature or half-mature fibres. If, as in the present case, the saw-ginned samples are found to give more neppy yarns, it is possibly due to the rolling up of the short bits into which some of the longer fibres may break during their passage through the gin.

(5) Fibre-maturity did not yield a significant simple correlation with mean-length but detailed analysis shows that a majority of short staple cottons possess high percentages of mature hairs, while a majority of the comparatively long-staple cottons are characterised by low percentages of mature hairs.

(6) High fibre maturity goes hand in hand with high fibre-weight per inch and high fibre-strength, the simple correlation coefficients between the two attributes being + 0.60 and + 0.72 respectively. The mature fibres

are so definitely stronger than the immature ones, that, in every case, the lower quartile for the former is greater than the upper quartile for the latter.

(7) Yarn-neppiness is significantly correlated to the number of immature hairs in a cotton, the values of simple and biserial correlation coefficients for 31 samples being  $+0.49$  and  $+0.81$  respectively.

(8) Other factors such as the proportion of half-mature hairs and the type of gin employed, which may be responsible for causing yarn-neppiness are considered. On making due allowance for these factors, the simple correlation coefficient between yarn-neppiness and the combined percentage of immature and half-mature hairs is found to be  $+0.67$  for 28 samples.

(9) The influence of such factors as (a) fuzz and matted fibre, (b) the dispersal of some immature fibres in the even (nep-free) yarn, (c) the presence of some mature hairs in the neps, and (d) the difficulty of ascertaining accurately the number of neps, in lowering the observed correlation coefficients is considered.

(10) The influence of fibre-maturity on the spinning value of a cotton is found to be masked by the other fibre-properties, notably mean fibre-length and fibre-weight per inch. On making a detailed analysis it was found that, in medium and long-staple cottons, higher fibre-maturity is usually associated with better spinning performance, while in short staple cottons the reverse is the case, the relative simple correlation coefficients for the two classes of cottons being  $+0.56$  and  $-0.66$  respectively. The importance of taking into account maturity percentages, in addition to other fibre-properties, in judging the quality of a cotton is discussed.

## V. GENERAL.

The work of the extension of the Spinning Laboratory block as sanctioned by the Committee was begun on the 5th January 1935 and was completed on the 30th April 1935. The first step in this direction was the acquisition of more land for the Laboratory, as not only the available building area on the present site was insufficient for the proposed extensions but the building activity in the surrounding area made it necessary to look to future needs of the Laboratory. In order to make room for the new blow-room plant the blow-room was extended in length by about 30 feet. For this purpose, the old cotton samples room was merged into the blow-room and a new samples room was built contiguous to it. The new samples room is bigger than the old one as the number of samples which have to be stored now is much greater than in the past. Furthermore, in view of the congestion in the spinning room, two new rooms were built contiguous to it. To one of these the gins and the *kapas* opener, which had so far been in the spinning room were transferred, while the other was fitted up for work on the utilisation of short staple cottons for the production of artificial silk to which a reference has already been made.

The Yarn Testing Room had also become highly overcrowded owing to the rapid increase in the work of the Laboratory and was extended in length by about 22 feet. The humidifying ducts leading to this room were also suitably extended so as to maintain the enlarged room at the proper humidity. The extension of the Yarn Testing Room necessitated the demolition of the old boiler house and a new one was built for this purpose. Furthermore, as it was felt that the whole compound of the Laboratory consisting of the old site and the newly acquired plots should be protected by one enclosure wall, the present walls on the east and west side were extended and a new wall was built on the north side. All these extensions were completed on the 25th May 1935 and were formally opened in the presence of the President, Vice-President, local members of the Committee and prominent representatives of trade and industry on the 29th May 1935. The total cost of the extensions including the buildings, machinery, etc., but excluding the cost of the new plots, came to Rs. 40,400.

*Staff.*—The staff of the Laboratory, as on the 31st August 1935, was as follows :—

*Director.*—Dr. Nazir Ahmad, M.Sc., Ph.D., F.Inst. P.

#### RESEARCH LABORATORY.

##### *Physics Section :—*

*Senior Research Assistants.*—Hari Rao Navkal, M.Sc. ; Ram Saran Koshal, M.Sc.

*Junior Research Assistants.*—C. Nanjundayya, M.Sc. ; Dr. K. R. Sen, D.Sc.

*Senior Testing Assistant.*—S. S. Sukthankar, L.T.C.

*Junior Testing Assistants.*—K. G. Deo ; C. S. Ramanathan, B.Sc. ; R. G. Parvalkar, B.Sc. ; S. Samson, B.Sc. ; M. R. Raut, M.Sc.

##### *Chemistry Section :—*

*Senior Research Assistant.*—D. L. Sen, M.Sc., Tech., M.Sc., A.I.I.Sc., A.I.C.

*Temporary Chemist.*—Dr. L. Thoria ; Dr. Inge (Germany).

##### *Microscopy Section :—*

*Junior Research Assistant.*—A. N. Gulati, M.Sc.

*Draughtsman.*—B. G. Mehta.

*Instrument Maker.*—J. B. Kharas.

## SPINNING LABORATORY.

*Spinning Master*.—R. P. Richardson, F.T.I.

*Spinning Assistant*.—N. Iyengar.

*Electrician*.—Herculano Lobo, L.E.E.

*Clerk*.—D. C. Mullan.

*Yarn Testing Section* :—

*Statistician and Personal Assistant*.—V. Venkataraman, M.A.

*Senior Testing Assistant*.—H. B. Joshi, B.Sc.

*Junior Testing Assistants*.—G. D. Bhide, B.Sc. ; K. V. N. Nayar ; V. N. Modak, B.Sc. ; L. V. Sundararaman, B.A. ; P. S. Sambamurthi ; G. J. Kharkar, B.Sc. ; A. J. Farid ; U. K. Benegal, B.A. ; P. V. Nachane, B.Sc. ; A. B. Khan, B.Sc.

*Statistical Clerks*.—R. Krishna Iyer ; P. K. Wagle.

## DIRECTOR'S OFFICE.

*Head Clerk*.—M. T. Majmudar.

*Stenographers*.—M. T. Sundaram ; M. A. Marar.

*Laboratory Keeper*.—H. P. Sethna, B.Sc.

Mr. R. P. Richardson, Spinning Master, proceeded on leave out of India on the 10th September 1934 and returned to duty on the 11th January 1935. During this leave period, Mr. N. Iyengar, Spinning Assistant, was appointed to officiate as Spinning Master.

Mr. M. M. Patke, Instrument Maker, resigned his post from the 15th February 1935 and this post was filled up by the appointment of Mr. J. B. Kharas on a revised scale of pay. Mr. Kharas joined the Laboratory on 18th February 1935.

In order to cope with the increased work in the Fibre and Yarn Testing Sections of the Laboratory, two posts of temporary Junior Testers were created for a period of four months each. These were filled up by Messrs. G. Hurry and C. A. S. Iyer who worked in the Laboratory from 10th December 1934 to 9th April 1935.

Due to the resignation of Mr. D. F. Kapadia, Mr. R. S. Koshal was confirmed in the permanent post of Senior Research Assistant and Dr. K. R. Sen, Technological Assistant at Lyallpur, was appointed to the vacant post of Junior Research Assistant on a revised scale of pay. Dr. Sen joined his duties at the Laboratory on the 17th May 1935.

Mr K S Mirar, Junior Tester, who was appointed Technological Assistant, Sakrand, was relieved on the 30th April 1935 to join his new post and his post was filled up by the appointment of Mr C S Ramanathan, who joined the Laboratory on the 4th June 1935

Mr K G Deo was transferred to Lyallpur as Officiating Technological Assistant to relieve Dr K R Sen. He worked there till relieved by Mr S Raja Raman, M Sc, who was appointed as Technological Assistant, Lyallpur. Mr Raja Raman was given the necessary training in the Laboratory prior to taking over the charge of his duties at Lyallpur. He completed his training on the 11th September 1935 and proceeded to Lyallpur to relieve Mr K G Deo, who reverted to his substantive post of Junior Tester in the Laboratory.

Mr M. A. Gangot, Junior Tester, resigned his post on the 22nd May 1935 to take up an appointment under the Department of Industries, Bombay. This post was filled by the appointment of Mr M R Raut, M Sc, who joined his duties on the 10th June 1935.

In connection with the investigation on the possibility of the utilisation of short staple cottons for the manufacture of artificial silk and staple fibre, a temporary post of a Chemist was created for one year and Dr L. Thoria was appointed to this post. He joined the Laboratory on the 1st May 1935.

As in the past, two students from outside, viz, Messrs P H Bhutta and V S Matkar were selected for training at the Laboratory from 1st December 1934 for a period of six months. Their period of training expired on the 31st May 1935.

During the period under review, the writer was elected a Fellow of the Institute of Physics, London, and a Fellow of the Indian Academy of Sciences, Bangalore. He was also nominated by the Government of Bombay as a member of the Board of the Victoria Jubilee Technical Institute, Matunga and a Fellow of the University of Bombay.

Mr D L Sen, Senior Research Assistant, was sanctioned by the Committee one year's study leave outside India and he left India on the 20th September 1935 to join the College of Technology, Manchester.

The temporary post of Personal Assistant was extended for a further period of one year and Mr V Venkataraman continued to hold that post in addition to his own duties.

Mr H B Joshi continued to be in charge of the Yarn Testing Section.

The Indian Central Cotton Committee at its meeting held on the 4th February 1935 while reviewing the work of the Laboratory desired that a brochure containing an account of the past work of the Laboratory be written up by the undersigned together with a programme of work for the future. The brochure and the programme were considered by the Committee at its

meeting held on the 20th August 1935 and it was decided that the brochure should be published for the information of the public.

As in the past the Laboratory has continued to attract a large number of visitors. These included prominent men, people connected with the textile trade and industry, students of agricultural, commerce and technical colleges, etc. It may also be stated here that the Laboratory possesses a small but well-equipped Library of its own. The Library contributes to most of the leading journals devoted to textile research and every effort is made to keep it up to date.

*Equipment.*—During the period under review, the following machines and apparatus were added to the equipment of the Laboratory :—

*Machines :—*

- (1) Horizontal opener cleaner.
- (2) Cage Exhaust.
- (3) New Hopper Feeder with three step cone pulleys.
- (4) Improved dust trunks with vibrating grids.
- (5) Two cyclones.

All the machines were supplied by Messrs. Tweedales and Smalley (1920) Ltd., Castleton, Rochdale. In addition, the old hopper feeder has been provided with strong upright and eveners lattices and the old Crighton opener with new triangular grid bars and new sets of blades. The scutcher has now been equipped with a variable speed motor in which the beater speed can be varied from 500 to 1000 r.p.m. Another important feature of the present blow-room is the provision of a bye pass by means of which the Crighton opener can be thrown out in the case of clean cottons for which a milder blow-room treatment is regarded sufficient.

- (6) Two new Electric motors one of  $8\frac{1}{2}$  H.P. and the other of 13 H.P., supplied by the Asea Electric Limited, Bombay.
- (7) One Brunswiga Calculating Machine.

*Apparatus :—*

- (1) Single Yarn Twist Tester manufactured by the Fine Cotton Spinners' and Doublers' Association, Rock Bank, Bollington, Cheshire.
- (2) One Strength Tester with graphic recorder manufactured by Louis Schopper, Leipzig, Germany, for artificial silk work.
- (3) One Electric Oven by Messrs. Baird and Tatlock (London) Limited.



## ACKNOWLEDGMENTS.

In presenting this report I wish to express my gratefulness to the office-bearers of the Indian Central Cotton Committee for the deep and sympathetic interest they have uniformly taken in the work of the Laboratory, to the East India Cotton Association, to Major Ellis Jones and Messrs. C. P. Bramble and Varjivandas Motilal for the supply and valuation of samples and to the entire staff of the Laboratory for their loyal co-operation which made the work possible.

NAZIR AHMAD,

*Director,*

*Technological Laboratory.*

*Dated the 9th November 1935.*

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## CHAPTER VII.

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### REPORT OF THE PUBLICITY AND PROPAGANDA OFFICER FOR THE YEAR ENDING 31ST AUGUST 1935.

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#### INTRODUCTION.

THE past year was one of sustained progress for the Propaganda and Publicity Department. The vital contact that the Department maintains between the activities of the Indian Central Cotton Committee on the one hand and the needs and interests of the cultivator, general public and government departments on the other was widened and deepened. The Department's activities were not exhausted by the publication and broadcasting of information. Important as this side of its activities was, the more vital purpose was to act as a sensory nerve keeping in live touch with the increasing requirements of the cotton world, and assisting the Committee to direct its work along the most fruitful channels.

Cotton interests not only in India but those outside drew upon the resources of the Department and the contact established during the last few years between the Committee and organisations in England and Japan continued unbroken. Through this Department the efforts of the Lancashire Indian Cotton Committee to increase the off-take of Indian cotton and thereby to promote the cotton trade between the two countries obtained wide publicity throughout India.

#### PINK BOLL-WORM CONTROL EXTENSION CAMPAIGN IN THE UNITED PROVINCES.

The most notable event during the period under report was the province-wide campaign conducted by the Publicity Officer for the extension of control measures of the pink boll-worm, a pest of cotton which in one year caused a loss of nearly  $2\frac{1}{2}$  crores of rupees to the crop in the United Provinces, and the enquiry connected therewith for the purpose of finding out what amount of cess should be levied to meet the cost of heating machines, their installation and working expenses, etc. The campaign extending over three months from the beginning of the year was preceded by two brief visits of a fortnight's duration each time paid to the experimental area with a view to study the effect of sun heating of the village stocks of cotton seed (*binaula*) in the areas then under pink boll-worm control in the districts of Aligarh, Saharanpur and Bijnor and later on to see the results of the heating process at the commencement of the harvest. The decided superiority of the crops in the treated area over the adjacent uncontrolled area both in regard to the stand of the plant, the opening of the bolls and the quality and quantity of the lint produced, by comparing the yield per acre,

and the price realised, convinced me of the efficacy of the method of sun heating the seed for completely destroying the pest which had resulted in a considerable improvement of the crop to the thorough satisfaction of the grower, and of the vital necessity of extending the control measures

#### DEMONSTRATION AT THE COUNCIL HALL, LUCKNOW

A noteworthy feature of the campaign was the staging of a special demonstration illustrative of samples of cotton, which were supported and explained by printed labels charts and graphs relating to the scheme in the Council Hall of the Legislative Council of the United Provinces. Considerable impetus to the focussing of attention of the members on the importance of adopting the scheme of Pink Boll Worm Control Extension was imparted by the organisation of demonstration on the 11th and 12th and again on the 20th of March, at a time when the session was in progress. The members were taken round the exhibits whereafter there was a conference. The Pink Boll Worm posters in English, Hindi and Urdu attracted much attention. Questions relating to the loss caused by the pest and the striking gain that had resulted in the quality and quantity of *kapas* of the areas where control methods had been applied were freely asked and answered.

In taking stock of the extensive and thorough propaganda campaign in the United Provinces which closed in the middle of April, the following observations and accomplishments may be of interest —

- (1) Local interests all over the province were notified of my visit and a well planned propaganda campaign commencing several weeks in advance of my visit to the station was found most effective. A circular letter stating the object of the campaign and the purpose of the enquiry connected therewith was mailed to all notable persons from the Entomologist's office at Cawnpore. This made the task of organising province wide meetings and/or obtain personal interviews with the co-operation of the civil authorities more thorough. Nothing was left to chance as regards eliciting the views of those I met. Hundreds of meetings and conferences were held in townships and villages.
- (2) In advance of and during the campaign there were sent out numerous circulars of informations giving facts regarding improvements carried out as the result of sun heating the seed and other information necessary. A Pink Boll Worm Bulletin giving the main features of the scheme of extension was written incorporating control measures.
- (3) A ten colour poster to further the campaign was likewise prepared. About 5,400 leaflets and 1,400 posters were issued to growers, merchants, ginners and other men of influence.

- (4) The campaign brought together men from all interests concerned with cotton industry and others indirectly allied with it with one object in mind, and that is to protect the crop from the ravages of the pest and avoid the colossal preventible loss caused by it.

Excellent co-operation was extended to the Publicity Officer by all interests concerned—the Department of Agriculture, United Provinces, *Zamindars*, businessmen, ginners and other allied interests. Newspaper publicity was carefully handled in order to prevent undue alarm in those districts of the province where propaganda in favour of the scheme had not been carried out. At the same time sufficient information was disseminated in the affected areas to focus attention and secure action from farmers whose crops were menaced, and their representatives in the Legislative Council.

This vigorous Pink Boll-Worm Extension Campaign has, I think, remarkably succeeded in bringing to the attention of the interests concerned and the public the real necessity of tackling the problem and the benefits which will accrue to the cotton crop of the United Provinces by so doing.

A 46-page report of the tour and enquiry in the United Provinces has been submitted to the Government of the United Provinces. Copies were placed on the table for members' information during the last half-yearly meeting of the Indian Central Cotton Committee.

#### PRESS COMMUNIQUÉS.

During the year under report the Publicity Officer issued the following press communiqués :—

- (1) *The Reports of the 29th and 30th meetings of the Indian Central Cotton Committee.*
- (2) *Development of Cotton Growing in Sind.*
- (3) *Development of Cambodia Cotton in Coimbatore District.*
- (4) *Development of Cotton Cultivation in Central Provinces.*

A press note was issued on "*Facilities for training at the Technological Laboratory, Matunga*", to bring to the notice of the public that the Technological Laboratory would admit this year two students for training in the elements of spinning and the routine methods of testing cotton fibre and yarn.

- (5) *Combing of Good Quality Indian Cotton.*
- (6) *Effect of Storage prior to Ginning on the Spinning Quality of Cotton.*
- (7) *Development of Cotton Growing in the Bombay Presidency.*

## SPECIAL ARTICLES

The Publicity and Propaganda Officer has been sending out special articles to the press. These articles are in a language easily understood by the layman and contain much timely information. Through them the wider public is kept constantly in touch. The following articles based on literature already available were contributed and published —

- (1) *Problems of Cotton Growing in the Central Provinces and Berar* — (Published in *Hindustan*, Nagpur, and the *Civil & Military Gazette*, Lahore)
- (2) *Improving the Indian Cottons* — (Published in *Textile Weekly*, Manchester)
- (3) *Improvement of Broach Cotton* — (Published in *Textile Mercury & Argus*, Manchester)
- (4) *Survey of Commercial Indian Cottons* — (Published in *Current Science*, Bangalore)
- (5) *Yarn Testing and Its Importance to Cotton Mills* — (Published in *Indian Textile Journal*, Bombay)
- (6) *High Draft Systems of Spinning and Their Importance to Trade* — (Published in *Indian Textile Journal*, Bombay)
- (7) *Cotton—India's Greatest National Industry* — (Published in *Indian Textile Journal*, Bombay)
- (8) *Promotion Activities with Respect to India's Cotton Production this Year and thereafter* — (Published in *Cotton Trade Journal*, America)

The last article formed a special feature of the Annual International Edition of the *Cotton Trade Journal*, America. This is creditable inasmuch as the journal is the foremost cotton journal in the world.

## PAMPHLETS

The Publicity and Propaganda Department continued to regard as its prime function the dissemination of the results of scientific cotton research through the medium of publications and distribution of publicity literature—pamphlets, leaflets, handbills and articles to the press. During the period under report the following pamphlets and leaflets were issued —

- (1) *Pink Boll-Worm Pest of Cotton and How to Control It* — This is an illustrated, finely printed popular pamphlet in English specially prepared for propaganda work in the United Provinces, describing the pink boll worm pest of cotton and how to control it. It deals

with the life of the pink boll-worm and the injury to the cotton crop caused by the caterpillar larvæ of the moth, *Platyedra gossypiella*, which feeds upon the developing seed inside the cotton boll.

- (2) *Summary of the Proceedings of the 29th Half-yearly Meeting of the Indian Central Cotton Committee.*
- (3) The pamphlet on "*Pink Boll-Worm Pest of Cotton and How to Control It*" has also been published in the two vernaculars, Hindi and Urdu, the popular languages in the United Provinces. They are also being utilised for the Pink Boll-Worm Control Campaign in the United Provinces.
- (4) *Cultivation of Cotton on the Indus Right Bank Areas.*—Promotion of the growth of improved type of Punjab-American cotton (4F-18) on the Right Bank section of the river Indus under perennial irrigation assured by the Lloyd Barrage Canals has been going apace with remarkable rapidity. The Publicity and Propaganda Department of the Indian Central Cotton Committee had a large say in the well organised local propaganda effort by suggesting suitable methods of securing effective propaganda and by supplying literature specially prepared to gain the end in view.

A Sindhi edition of this, since brought out, has rendered considerable assistance.

Referring to these publications the Progress Report for the year 1934-35 of the Sind Seed Distribution and Extension Scheme says "A suitable illustrated leaflet in Sindhi and English designed and published by the Publicity Officer of the Indian Central Cotton Committee was widely distributed in the tract . . . . A suitable cotton poster specially designed for the Right Bank Area, issued by the Publicity Officer of the Indian Central Cotton Committee in co-operation with the Chief Agricultural Officer in Sind, was displayed at railway stations, important thoroughfares and public offices. All the above methods of publicity have good effect on the extension of cotton cultivation as will be seen from the extension programme of the work during the current season."

#### POSTERS.

During the period under review a striking ten-coloured poster on the pink boll-worm pest of cotton was prepared in English specially for the propaganda campaign in the United Provinces. The poster is self explanatory and deals with the subject which the special pamphlet illustrated. It shows eight small pictures arranged in the margin dealing with the life history and development of the pink boll-worm as also the damage done to the cotton crop by this pest. The central picture is designed to show two cultivators

with cart loads of *kapas*—one stained and the other of good quality, uninfected by the pink boll worm. There are two buyers also and the conversation between the one cultivator and the buyer and the other pair draws attention to the urgency of heating the cotton seed in a language clear and simple.

Hindi and Urdu versions of the poster have also been prepared. Photographic prints of the poster on "The Pink Boll Worm Pest of Cotton" prepared for the campaign in the United Provinces were also sent to the press in India and abroad.

A Telugu version of the poster "India's Bid for Supremacy in World's Cotton Markets" was printed for use in the Madras Presidency. The poster deals with the export figures of cotton and emphasises the national and international importance of this commodity.

### EXHIBITIONS

The Department participated in—

- (1) The *Exhibitions at Nanded* organised by the Agricultural Department, Hyderabad State, on 30th November and 1st December 1934.
- (2) The *Kolhapur Fair* which was held in the 2nd week of May 1935.
- (3) The *All-India Exhibition* which commenced on the 15th of December 1934 in Lahore.
- (4) The Agent, Japan Cotton Spinners' Association, Bombay, asked for photographs and models showing the various activities of cotton agriculture in India as also the activities of the Indian Central Cotton Committee's Technological Laboratory at Matunga. He further requested for pamphlets for the dissemination of scientific information bearing on problems which the Committee was tackling and posters for use at the *Memorial Exhibition at Formosa (Japan)*. In addition to the supply of publications and posters he was provided with a number of large clear photos on the different sections of the Technological Laboratory.

### HEAVY DEMAND ON PUBLICITY LITERATURE

There is a constant demand for free literature dealing with cotton subjects and although supplies are somewhat limited, several thousands of pamphlets, leaflets and other publications are distributed to applicants during the year. In addition to the heavy demand on publicity literature from all over India (including the Indian States) requests are also received from abroad. Mr A E Wilson of Royds Hall, Great Britain, requested a supply of all illustrated publications dealing with cotton growing in India to help him in preparing lantern

slides for a series of lectures he was going to deliver. The Chief, Periodical Division, U. S. Department of Agriculture Library, Washington, requested for press communiqués for 1933-34 and other publications of the Department.

#### APPRECIATIVE REFERENCE TO THE COMMITTEE'S PUBLICITY WORK.

"The Indian Central Cotton Committee maintains its excellent work", comments the British Cotton Growing Association in their 13th Annual Report (1934), "and several matters of great importance to the industry in India have engaged its attention during the past year. The various reports issued by its Publicity Officer have contained information of much interest and have done good propaganda work in disseminating scientific and practical information relating to the improvement of cotton in India . . . etc."

R. D. MIHRA,

*Publicity & Propaganda Officer.*

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## APPENDIX I.

## MEMBERS OF THE COMMITTEE

## (1) PRESIDENT —

Dewan Bahadur Sir T. Vijayaraghavacharya, K B E., Vice-Chairman Imperial Council of Agricultural Research, *ex-officio*

(a) The Expert Adviser to the Imperial Council of Agricultural Research in Agricultural matters *ex-officio*

## (2) REPRESENTATIVES OF AGRICULTURAL DEPARTMENTS —

*Madras* .. . . M R. Ry. Rao Bahadur D. Ananda Rao Garu, I. A. S.

*Bombay* .. . . The Director of Agriculture

*United Provinces* .. . . Mr R. G. Allan, I. A. S., Director of Agriculture

*Punjab* .. . . Mr H. R. Stewart, I. A. S., Director of Agriculture

*Central Provinces* .. . . Mr J. H. Ritchie, I. A. S., Director of Agriculture

*Burma* .. . . Mr F. D. Odell, I. A. S., Deputy Director of Agriculture, West Central Circle, Magwe

(3) THE DIRECTOR-GENERAL OF COMMERCIAL INTELLIGENCE AND STATISTICS, *ex-officio*

## (4) REPRESENTATIVES OF CHAMBERS OF COMMERCE AND ASSOCIATIONS —

The East India Cotton Association .. . . Sir Purshotamdas Thakurdas Kt., C. I. E., M. B. E., (*Vice President*)

The Bombay Millowners' Association .. . . Mr S. D. Saklatvala, M. L. C.

The Bombay Chamber of Commerce .. . . Mr A. A. Sarantides

The Indian Merchants' Chamber .. . . Mr Chunilal B. Mehta

The Karachi Chamber of Commerce .. . . Mr G. C. R. Coleridge

The Ahmedabad Millowners' Association .. . . Seth Sakarlal Balabhai, M. L. C.

The Tuticorin Chamber of Commerce .. . . Mr J. Vonesch

The Upper India Chamber of Commerce .. . . Mr J. Tinker

The Empire Cotton Growing Corporation .. . . Mr W. Roberts, C. I. E.

## (5) and (6) COMMERCIAL REPRESENTATIVES NOMINATED BY LOCAL GOVERNMENTS —

*Central Provinces* .. . . { Mr Y. G. Deshpande  
Rao Bahadur G. R. Kothare, M. L. C.

*Madras* .. . . Mr J. Nuttall

*Punjab* .. . . Khan Bahadur Sardar Habibullah, M. L. C.

*Bengal* .. . . Mr Akhil Bandhu Guha

## (7) CO-OPERATIVE BANKING REPRESENTATIVE —

Rao Bahadur M. G. Deshpande, C. B. E.

## (8) REPRESENTATIVES OF COTTON-GROWING INDUSTRY.—

<i>Madras</i>	..	..	..	{ Mr. K. S. Ramaswami Gownder. M.R.Ry. Rao Bahadur B. P. Sessa Reddi Garu, M.L.C.
<i>Bombay</i>	..	..	..	{ Sardar Rao Bahadur Bhimbhai Ranchodji Naik, M.L.C. Rao Bahadur C. S. Shirahatti.
<i>United Provinces</i>	..	..	..	{ Khan Bahadur Shah Nazar Husain, M.L.C. Rai Bahadur Lala Anand Sarup, M.L.C.
<i>Punjab</i>	..	..	..	{ Sardar Sampuran Singh, M.L.C. Mian Nurullah, M.L.C.
<i>Central Provinces and Berar.</i>				{ Mr. N. M. Deshmukh. Mr. J. B. Deshmukh.

## (9) and (10) REPRESENTATIVES OF INDIAN STATES.—

<i>Hyderabad State</i>	..	..	..	Mr. Nizam-ud Din Hyder, Director of Agriculture.
<i>Baroda State</i>	..	..	..	Mr. C. V. Sane, Director of Agriculture.
<i>Gwalior State</i>	..	..	..	Mr. H. H. Pandya, Director of Agriculture.
<i>Rajputana and Central India States.</i>				Mr. F. K. Jackson, Director, Institute of Plant Industry, Indore.

## (11) ADDITIONAL MEMBERS NOMINATED BY THE GOVERNOR-GENERAL-IN-COUNCIL.—

1. Mr. D. N. Mahta, Economic Botanist for Cotton, Central Provinces.
2. Rao Bahadur S. S. Salimath, Deputy Director of Agriculture, Southern Division, Dharwar.
3. Dr. V. K. Badami, Ph.D., Deputy Director, Department of Agriculture in Mysore State, Bangalore.
4. M.R.Ry. V. Ramanatha Ayyar Avl., Cotton Specialist, Coimbatore.
5. Musahib-i-Khas Bahadur S. V. Kanungo, Finance Minister, Holkar State, Representative of the Holkar State.
6. Mr. K. I. Thadani, Botanist in Sind, Agricultural Research Station, Sakrand.
7. Seth Isserdas Varindmal, Representative of the Karachi Indian Merchants' Association.
8. Mr. P. B. Richards, I.A.S., Entomologist to Government, United Provinces.
9. Khan Bahadur Nawab Fazl-i-Ali Khan, Chairman, District Board and President, Central Co-operative Bank, Ltd., Gujrat (Punjab).
10. Khan Saheb Farrukhbeg Sadikalibeg Mirza, Nawabshah, Sind.
11. Lala Shri Ram, Representative of the Cotton Millowners of Delhi.
12. Mr. Chellaram Shewaram, Representative of the Karachi Cotton Association, Ltd.

## APPENDIX II.

## CONSTITUTION OF SUB-COMMITTEES

## STANDING FINANCE SUB COMMITTEE

Dewan Bahadur Sir T Vijayaraghava charya ( <i>Ex-officio</i> )	Mr J Vonesch
Sir Purshotamdas Thakurdas ( <i>Chairman</i> )	Mr Chunilal B Mehta
Mr S D Saklatvala	Mr G C R Colendge
Sardar Rao Bahadur Bhimbhai Ranchodji Naik	Rao Bahadur G R Kothare
	Mr A A Sarantides

## LOCAL SUB-COMMITTEE

Dewan Bahadur Sir T Vijayaraghava charya	Mr J Vonesch
Sir Purshotamdas Thakurdas	Mr Chunilal B Mehta
Mr S D Saklatvala	Mr G C R Colendge
Sardar Rao Bahadur Bhimbhai Ranchodji Naik	Rao Bahadur G R Kothare
	Mr A A Sarantides

## COTTON GINNING AND PRESSING FACTORIES SUB COMMITTEE

Sir Purshotamdas Thakurdas	Mr G C R Colendge
Mr S D Saklatvala	Mr J Nuttall
Mr J Vonesch	Mr W Roberts
Mr Chunilal B Mehta	Mr Y G Deshpande
	Vacant (two places)

*The Co operative Representative*—Rao Bahadur M G Deshpande and  
Mr Chellaram Shewaram—(*Co-opted Member*)

## AGRICULTURAL RESEARCH SUB COMMITTEE

- I *The President*—Dewan Bahadur Sir T Vijayaraghavacharya (*Ex officio*)
- II *The Vice President*—(*Ex officio*)
- III *The Director, Institute of Plant Industry*—Mr F K Jackson (*Ex officio*)
- IV *The Co operative Representative*—Rao Bahadur M G Deshpande (*Ex officio*)
- V *Cotton Growers Representative*—Mr W Roberts

- VI. *Cotton Trade Representative*.—Rao Bahadur G. R. Kothare (Co-opted for the August 1935 meeting).
- VII. *Four Agricultural Officers*.—Mr. B. S. Patel ; Mr. J. H. Ritchie ; Mr. H. R. Stewart ; Mr. V. Ramanatha Ayyar.
- VIII. *Additional Members*.—Mr. B. C. Burt, Mr. R. G. Allan ; Mr. K. I. Thadani, (Co-opted for the August 1935 meeting); Rao Bahadur D. Ananda Rao Garu, (Co-opted for the August 1935 meeting); Mr. D. N. Mahta ; Mr. P. B. Richards; Mr. C. V. Sane ; Mr. Chunilal B. Mehta ; Mr. Nizam-ud Din Hyder ; Mr. H. H. Pandya.
- IX. *Co-opted Members*.—Mr. Mohammad Afzal ; Rai Saheb Kalidas Sawhney ; Mr. J. B. Hutchinson,
- and
- X. *The Secretary*.

#### TECHNOLOGICAL RESEARCH SUB-COMMITTEE.

The President ( <i>Ex-officio</i> ).	Mr. Chunilal B. Mehta.
Sir Purshotamdas Thakurdas.	Seth Sakarlal Balabhai.
Mr. B. C. Burt.	Mr. J. Tinker.
Mr. B. S. Patel.	Mr. A. A. Sarantides.
Mr. H. R. Stewart.	Mr. Y. G. Deshpande.
Rao Bahadur D. Ananda Rao Garu.	Lala Shri Ram.
Mr. S. D. Saklatvala.	Dr. Nazir Ahmad.
Mr. A. D. Walwyn, Mr. Dharamsi Mulraj Khatau, (Representing the Bombay Mill-owners' Association).	
Mr. Kasturbhai Lalbhai, Seth Chamanlal G. Parekh, (Representing the Ahmedabad Millowners' Association).	
Mr. R. G. Saraiya, Mr. Jamnadas Ramdas, (Representing the East India Cotton Association, Ltd.).	
Seth Isserdas Varindmal, (Representing the Karachi Cotton Association, Ltd.).	

#### RESEARCH STUDENTS SELECTION SUB-COMMITTEE.

The President.	Mr. F. K. Jackson.
The Vice-President.	Mr. C. V. Sane.
Mr. B. C. Burt.	Mr. H. H. Pandya.
Mr. B. S. Patel.	Mr. Nizam-ud Din Hyder.
Mr. H. R. Stewart.	Dr. Nazir Ahmad.
Mr. J. H. Ritchie.	The Mysore Representative (Dr. V. K. Badami), and
Mr. R. G. Allan.	Vacant (two places).
Mr. P. B. Richards.	

## SUB COMMITTEE ON MALPRACTICES

Sir Purshotamdas Thakurdas	Sardar Sampuran Singh
Mr B S Patel	Seth Sakarlal Balabhai
Mr G C R. Coleridge.	Seth Isserdas Varindmal
Mr Chunilal B Mehta.	Vacant.

## COTTON FORECAST IMPROVEMENT SUB COMMITTEE

The President.

The Director General of Commercial Intelligence and Statistics, Calcutta

The Director of Agriculture, Bombay Presidency

Do	do	Punjab
Do	do	Madras
Do	do	United Provinces

The Chief Agricultural Officer in Sind

The Director of Land Records Central Provinces and Berar

The Director of Agriculture, Baroda State

The Director of Statistics, H E H the Nizam's Government

The Deputy Director of Statistics, Calcutta

## SPECIAL SUB COMMITTEE ON WIDER MARKETS FOR INDIAN COTTON

The President	Mr R G Allan
The Vice-President	Khan Bahadur Sardar Habibullah
Mr B C Burt	Sardar Rao Bahadur Bhimbhai Ranchodji Naik
Mr H R Stewart	Rao Bahadur D Ananda Rao Garu (Co-opted for the August 1935 meeting)
Mr J H Ritchie	Mr Nizam ud Din Hyder
Mr B S Patel	Mr V A Tamhane, (Co opted for the August 1935 meeting)
Mr S D Saklatvala	Mr Kasturbhai Lalbhai, Mr R G Saraiya, (Co opted)
Mr J Vonesch	
Mr Chunilal B Mehta	
Mr Y G Deshpande	

## STANDARDS SUB-COMMITTEE.

Dr. Nazir Ahmad (Representing the Imperial Council of Agricultural Research).

Mr. Haridas Madhavdas, Mr. Varjivandas Motilal, (Representing the East India Cotton Association, Ltd.)

Mr. M. Napier, Mr. Nechaldas Chhangomal, (Representing the Karachi Cotton Association, Ltd.)

Mr. N. M. Deshmukh, Rao Bahadur G. R. Kothare, (Representatives of cotton growers of Berar Tract.)

Mr. Himatlal Jagjiwandas Vadodaria, Mr. Vadilal Chunilal Doshi, (Representatives of cotton growers of Mathia Tract.)

Mr. Akhubava Takatsinghji Chudasama, Rao Saheb Kevalbhai Desaibhai Desai, (Representatives of cotton growers of Dhollera Tract.)

Mr. Haribhai Jhaveribhai Amin, Mr. Ardeskar Jamshedji Kapadia, (Representatives of cotton growers of Broach Tract.)

Sardar C. B. Naik Bahadur Desai, Rao Bahadur B. L. Patil, (Representatives of cotton growers of Kumpta Tract.)

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## APPENDIX III.

## LIST OF RESOLUTIONS

- " That the International Federation of Master Cotton Spinners' and Manufacturers Associations be informed that the rule was amended at the request of the Committee on the representation of the East India Cotton Association who drew attention to cases of hardships and losses incurred by Bombay merchants because of bales being rejected in arbitration for faults in marking. The chief complaint was that the method of marking as laid down in the original rule was so meticulous that the East India Cotton Association arbitrators had no option but to reject any bales not marked strictly in accordance with the rule though the cotton was in all other respects a fair tender and even at times carrying an 'on' allowance. Under the circumstances, the Indian Central Cotton Committee regrets it is unable to revert to the original rule "
- " The Indian Central Cotton Committee recommends that a minimum balance should be maintained, and that it be Rs. 9 lakhs. There should be no objection, however, to draw upon this minimum balance in case of emergency, provided such shortages are made good as soon as conditions improve "
- " The Indian Central Cotton Committee views with alarm the spread of Garrow Hill cotton in the Central Provinces and Berar and strongly recommends to the Central Provinces Government to give immediate effect to Resolution 3 passed at the last meeting of the Central Provinces Provincial Cotton Committee held on the 19th September 1934 "
- " The Indian Central Cotton Committee views with great concern the increase in the practice of heavy mixing of Punjab-American and *desi* cotton which is taking place this year. The concession for long distance *kaphas* transport given by the N. W. Railway and other railways a few years ago has this year particularly, resulted in accentuating this practice. The concession on the N. W. Railway was the Committee believes, originally introduced to assist in the marketing of Bahawalpur cotton when ginning arrangements were inadequate. This is not now the case. This Committee wishes to press the Punjab Government to make enquiries and if possible, to move for the withdrawal of this concession in the general interest of the cotton growers of the province "
- " The Indian Central Cotton Committee requests the Government of India to take immediate steps to amend the Cotton Ginning and Pressing Factories Act No. 12 of 1925 so as to protect the interests of the cotton growers in all respects "
- " The Indian Central Cotton Committee wishes to place on record its sense of appreciation of the services rendered by Major W. Ellis Jones, extending over a period of ten years, in connection with the grading and valuing of cotton samples received for tests at the Technological Laboratory, and regrets that circumstances now compel him to relinquish this work "
- " The Indian Central Cotton Committee wishes to express its appreciation of the efforts made by the Lancashire Indian Cotton Committee to extend the use of Indian cotton in Lancashire as indicated in their first Annual Report and to assure that Committee of its desire to co-operate to the fullest extent possible in all matters affecting the interests of both bodies "
- " With reference to Bombay Government's Resolution of the 8th March, the Indian Central Cotton Committee appreciates the fact that the Local Government agree fully with the recommendations of the Chief Agricultural Officer in Sind, namely, that the compact block of long staple cotton in Sind can only be achieved by licensing of gins and presses, use of special marks in the licensed factories, seed supply organisation and organised marketing "

- " The Indian Central Cotton Committee now urges Government to translate these recommendations into action with the least possible delay and trusts they will not hesitate to introduce whatever legislation is necessary if the above measures prove inadequate. It further recommends, firstly, that the compact area be reserved for the growth (from specially selected Government seed) of long staple cotton only, such as, 289-F and N.T., and secondly that the Transport Act be introduced to prevent the importation of *kapas* from outside areas."
- " That in view of the fact that the scheme of work on spotted boll-worm control terminates in June 1936, the Central Cotton Committee desires to emphasise the necessity of legislative sanction being obtained before that date to enable the uprooting of cotton stalks to be enforced."
- " The Indian Central Cotton Committee requests the Central Provinces Government to reconsider the question of prohibiting the growing of Garrow Hill cotton, as in its opinion the action which the Local Government propose to take, *viz.*, the introduction of legislation to prohibit the sale of mixed cotton as pure, will not prevent the spread of this inferior cotton. The known presence of even small areas of an inferior cotton tends to lower prices in the markets where this cotton is sold and the growers of better quality cotton will also suffer. As the Central Provinces Government has accepted the policy of encouraging the growth of *Verum* cotton in the Central Provinces and Berar, the Indian Central Cotton Committee considers that the growing of Garrow Hill is inimical to that policy and positively detrimental to the interests of the better quality cotton growers and should be discouraged."
- " The Indian Central Cotton Committee regrets that the Government of India have not yet passed any orders on the unanimous Resolution of the Committee recommending to the Government of India to resume the broadcasting of cotton rates and hopes that the practice of broadcasting cotton rates will be resumed as soon as possible."
- " The Indian Central Cotton Committee welcomes the Bombay Cotton Control Bill which the Bombay Government propose to introduce in the local Legislative Council. The Committee is convinced that unless legislative action of this nature is taken *Goghari* cotton will spread rapidly in the Surat tract and ruin the reputation of 1027 A. L. F. cotton to the detriment of the cotton growers of the tracts affected."
- " The Indian Central Cotton Committee places on record, at this the last meeting of the Committee at which Sir T. Vijayaraghavacharya presides, the uniformly able and efficient manner in which Sir T. Vijayaraghavacharya presided over the Committee for six years. His consistent courtesy to each member and his unrivalled tact and patience in dealing with the various questions that were dealt with by the Committee have been an asset to the Committee."
- " The Committee records its best thanks to Sir T. Vijayaraghavacharya for the continued close attention he gave to details of the questions disposed of during this period and it tenders him its best wishes on the eve of his retirement."
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## APPENDIX IV.

### INSTITUTE OF PLANT INDUSTRY, INDORE, CENTRAL INDIA

*Annual Report for the year ending June 30th, 1935*

The Institute of Plant Industry is a Society registered under the Holkar State Societies Registration Act and its primary objects are —

- (a) The investigation of all matters relating to the production and improvement of raw cotton in India
- (b) The agricultural development of the Indian States which are members of the Society
- (c) The training of officers and cultivators nominated by such States
- (d) The training of advanced students nominated by the Indian Central Cotton Committee

Its funds are derived entirely from subscriptions. In the financial year 1934-35 the Indian Central Cotton Committee made a grant of Rs 1,15,000 and the member States in Central India and Rajputana subscribed Rs 61,950.

The Institute is subsidised by the Indian Central Cotton Committee primarily in order that it may act as a central research station for the elucidation of botanical and agronomic problems of cotton of too wide a nature to be attacked by *ad hoc* schemes. The Indian Central Cotton Committee has also a secondary interest in the Institute in its work for the improvement of variety and cultivation conditions of cotton in Central India and Rajputana.

The interests of the member States lie in the investigation of the specific crop problems of their own territory and in the development and dissemination of better seeds and more efficient agricultural practices.

The interests of the Indian Central Cotton Committee and of the member States are complementary, and provide a very satisfactory balance to the work of the Institute.

The Governing Body of the Institute is representative of the Cotton Committee and the member States and its President is the Agent to the Governor General in Central India, *ex-officio*. The Director of the Institute is also Agricultural Adviser to States in Central India and Rajputana, and in addition represents all those States upon the Indian Central Cotton Committee.

#### ADMINISTRATION AND GENERAL

1 *General and Board of Governors' Meetings* — A General Meeting of Members of the Society was held on December 22nd 1934 when the constitution was amended so as to make the representation of contributors on the Board of Governors proportionate to the amount paid annually. The Board met on October 6th and on December 23rd when the report for the year ending June 30th 1934 and the programme for the year 1935-36 were discussed and approved. The Board also sanctioned leave and deputation for Mr J. B. Hutchinson, Geneticist and Botanist to allow him to attend the Sixth International Botanical Congress at Amsterdam in September 1935. The Congress having complimented him by their invitation to read a paper in the genetics section it was felt desirable to enable him also to take advantage of the opportunity of discussion with other geneticists.

2 *Contributing Members of the Institute* — During the year the State of Jhabua in Central India and the Thikanas of Khetri in Jaipur and Bagli in Gwalior became members. One State, Jhalawar, has temporarily withdrawn from membership for financial reasons.



Mahendra Singh, Thakur, Revenue Member, State Council, Bundi (Rajputana).

Masih, Kenneth B. V., Christian College, Indore.

Mehta, Chunilal B., Member, Indian Central Cotton Committee, Bombay.

Mukerjee, R. K., Professor and Head of the Department of Economics and Sociology, University of Lucknow, U. P.

Mukerjee, W., Allahabad Agricultural Institute, Naini.

Myers, A. J. W., Hartford, Connecticut (U.S.A.).

Nadhkar, Dewan Bahadur K., Dewan and President, State Council, Dhar, C. I.

Naik, Bhimbhai, Sardar Rao Bahadur R., M.L.C., Member, Indian Central Cotton Committee, Surat.

Narsingarh, His Highness the Maharaja of.

Natu, R. S., B.S.E., Divisional Engineer, Yeshwant Sagar Works, Indore.

Orchha, His Highness the Maharaja of.

Parekh, Manilal, Rajkot, Kathiawar.

Patterson, G. (Miss), United Church of Canada Mission, Kharua, C. I.

Patwardhan, K. A., M.Sc., Master, Daly College, Indore.

Pearce, F. G., Principal, The Scindia School, Gwalior.

Pearson, D. (Miss), Mission Girls' High School, Indore.

Prabhunath Singh, Maharaj, Narsingarh, C. I.

Prayag, Rao Sahib C. H., Cotton Breeder, Jalgaon.

Rajkumar Singh, Managing Director, Rajkumar Mills, Indore, C. I.

Rama Reddi, P. H., M.A., B.Sc., I.A.S., Secretary, Indian Central Cotton Committee, Bombay.

Ram Prasad Singh, Rai Sahib, Thakur, Economic Botanist, United Provinces Government, Cawnpore.

Reenich, E. de C. (Miss), Companion to Her Highness the Maharani, Rewa, C. I.

Reshimwale, Gopal Rao, Sardar, Indore.

Roberts, Sir James R., Special Member, Council of State, Dewas (Senior), C. I.

Roberts, Lady, Dewas (Senior), C. I.

Sardar Kurgain H. A., M.A., I.E.S. (Retired), Late Inspector of Schools, Nerbudda Circle, C. P. and Southern Division, Bombay.

Sajjan Singh, Narsingarh, C. I.

Sangli, M. G., Jodhpur (Rajputana).

Sangli, S. G., C/o Sangli Bros., Indore, C. I.

Scott, Rev. A. A., Principal, Christian College, Indore.

Schneider, B. H., Dr. (with a party of 25 students), Allahabad Agricultural Institute, Naini.

- Short, H C., Commissioner in India, Lancashire Indian Cotton Committee  
 Sully, T D, Principal, St John s College, Agra  
 Talcherkar, V A, late Textile Expert to the Holkar Government, Indore  
 Taore, K A, Dr, Dewas (Senior), C I  
 Taylor, Rev J T, United Church of Canada Mission, Indore  
 Taylor, Rev H E, United Church of Canada Mission, Indore  
 Thakurdas Sir Purshotamdas, Kt., C.I.E., M.B.E., Vice-President Indian Central Cotton Committee, Bombay  
 Trench, C G, Chenevix, C.I.E., I.C.S. (Retired), Revenue Commissioner, Udaipur, Mewar  
 Vijayaraghavacharya, Dewan Bahadur Sir T., K.B.E., Vice-Chairman, Imperial Council of Agricultural Research, Delhi, President, Indian Central Cotton Committee  
 Wither, C. (Miss), Mission Hospital, Indore  
 Zalim Singh, Sardar, Kamavisdar, Dewas (Senior), C I  
 Zutshi, Dewan Bahadur B N, Vice President, State Council, Rewa, C I

5 *Library*—Accessions during the year were thus —

Text books and works of reference	71
Volumes of Journals . . .	193
Reports, Bulletins, etc	546
Total accessions	<hr/> 810 <hr/>

Six new journals have been added to the list of periodicals taken by the Library. Loans of 182 books and journals were made to cotton research workers and others and to libraries in India and abroad, a routine of circulation being in force. No less than 1 690 books and bulletins have been sold, to the value of nearly Rs 750. Progress has been made with the classification of the library by the Universal Classification System; the books and pamphlets have been re arranged on the shelves and a shelf index made for the latter.

#### RESEARCH WORK

6 *Organisation*—There is little new to record under this heading, the extra facilities provided mentioned in the last report have been fully utilised with increased output of work and efficiency. A still larger number of field trials have been handed over to the Farm Section for execution so freeing research staff for other work.

The methods referred to in the 1934 report of central control of field experiments in out stations have proved themselves and have been expanded, by their aid a very large mass of information of known accuracy has been acquired.

Once again the cordial co-operation of the States' Darbars and their officers as well as no small number of voluntary workers, must be acknowledged. With this aid much more rapid progress is made possible.

Similar acknowledgment is also due to the Provincial Departments of Agriculture, notably those of Bombay, the United Provinces, the Central Provinces, the Punjab and Madras for much assistance and co-operation willingly rendered, also to Agricultural

Departments in the United States of America, Australia, South Africa and other parts of the Empire and to officers of the Empire Cotton Growing Corporation.

7. *Weather and its effect on crops.*—In Malwa, following a *rabi* season of low rainfall, the 1934 monsoon was exceptionally heavy, a total of no less than 57.37 inches of rain being recorded, the yearly average being about 30 inches. Thus for the fourth successive year *kharif* crops on the black soils and also in East Central India suffered from the deterioration of soil through excess of moisture. Fortunately there were two breaks in the continuity of rainfall which enabled some recovery to be made. In the Nimar tract South of the Vindhya excellent crops were the rule and Rajputana with its lighter soils on the whole gained by the higher rainfall it experienced, although on the Eastern side late rains also did damage, particularly to cotton and small grain crops.

Severe frosts in mid-January caused much damage in all parts of Central India and Rajputana. The third pickings of cotton were usually destroyed and in some areas even the second; this has given a set-back to the improved Malvi cotton distribution schemes. Gram suffered badly, sugarcane was damaged, especially for use as seed, and tobacco in the early districts was cut to the ground and abandoned. Severe hailstorms harmed *rabi* crops in East Central India.

## 8. *Cotton—Botany and Genetics.*

### (a) *Botanical Survey of cottons in Malwa and Nimar.*

A draft paper on the *botanical classification of cotton* with special reference to Asiatic species has been written and awaits the verification of a few small points at the Herbarium, Royal Botanical Gardens, Kew. This paper deals with botanical principles only.

The analysis of the *survey of Malvi and Nimari cottons* is at present being written up. It is hoped in this paper to indicate the possibilities and limitations of an agricultural classification.

The survey data reveal very interesting and important differences in survival value of different types in Malwa and Nimar, and physiological work is being undertaken to discover the causes of the differences in plant response. The position of Upland types in the Malvi crop also appears to be anomalous, and experiments have been laid out to discover whether it can hold its own against *desi*, and if so, by what means.

Useful information has been obtained and valuable types have been selected from a collection of Burma and Assam types obtained through the good offices of the Hon'ble the Agent to the Governor-General in Central India.

(b) *Genetics.*—The study of X-rayed material yielded negative results. Some indications of cytological abnormality were noted but on further investigation they proved to be of small importance. This line of work has been suspended in favour of lines of more immediate value.

Work on the inheritance of major factors continues, and results are expected in the coming crop. Certain lines of study which on investigation proved likely to yield a small return for a large amount of work have been abandoned in favour of more promising subjects. The more important changes involved are the closing down of studies on minor lint colour factors and the exclusion of the study of aberrant mendelian ratios from the short petal experiments.

Work on the *inheritance of quantitative characters* has now become the main part of the genetics programme. The results obtained by the improved technique (see below under statistics) developed in the season under review have been very encouraging indeed.

and indicate that modern statistical principles are capable of providing a solution to what has in the past been one of the chief difficulties in the study of quantitative inheritance, namely the control of environmental variation. Work is proceeding in three main lines

- (i) The study of genetic variance in relatively uniform material. This has led to the discovery that considerable further improvement is possible in both Malvi 1 and Malvi 9 and also that Malvi 9 which is the better of the two is also the one which is capable of the greater further improvement. Variation between strains in susceptibility to wilt has been observed in Malvi 9 and has provided an opportunity of studying the inheritance of this character.
- (ii) The study of genetic variance in crosses between three important agricultural types of *G. arboreum* (Malvi, Ran and Roseum). It is intended in these crosses to study particularly the relation between characters of commercial importance and those responsible for the morphological differences between the types. Some information is already available concerning the extent to which the lint characters of one type may be combined with the morphological characters of another and it is hoped to extend and amplify it. This work links up naturally with the study of the survival value of different morphological types and will have an important practical application in delimiting the breeding potentialities of the commonly cultivated types of *G. arboreum* and in serving as a guide to plant breeders faced with the problem of combining the greatest possible vigour with the most desirable lint characters.
- (iii) The study of genetic variance in interspecific crosses.

Work on this subject was started in 1933 and  $F_2$  and backcrosses will be grown in the coming season. The programme has been enlarged and intensified in response to the need of plant breeders for information on this very obscure subject.

Study of the rate of mutation in mutable strains is proceeding slowly as mutable strains do not grow well in black soil. The occurrence of somatic mutation from brown to white lint (KK to kk) has, however, been demonstrated in heterozygous material.

(c) *Cytology*—Cytological work has demonstrated that in one of the two sterile mutant strains sterility is not due to cyto-genetic abnormality. The inheritance of sterility in this type remains obscure. The other strain has been shown to carry a simple mendelian recessive factor for sterility. The cytology of the sterility in the mendelian recessive is now being studied.

The study of hybrids between *G. africanum* (= *G. Anomalum*) and cultivated Asiatic cottons continues and second backcross seedlings are now being raised. It appears that the normal chromosome complement of all plants so far studied is 26 but certain plants contain small 'islands' of tetraploid tissue.

(d) *Physiology*—The study of hair characteristics has been slowed down pending receipt of the new tester designed by Dr Nazir Ahmad, Director of the Technological Laboratory Matunga, Bombay. The study of tests for lint quality to deal with large numbers of small samples is proceeding. The spinning value of Malvi cottons predicted from fibre tests appears to be almost 50 per cent higher than the actual value as determined by spinning tests.

(e) *Selection and Breeding*—The amount of seed of Malvi 1 and Malvi 9 available for distribution for 1935 *khari* was curtailed by the frost which destroyed the crop in the middle of January 1935. The demand for seed has been most encouraging and far beyond the supply available. Both Malvi 1 and Malvi 9 have been distributed and owing to the discovery that the two strains probably differ in their response to different soils and regions, both are being retained in the distribution scheme for the present.

A number of new selections from Malwa will be tested in replicated progeny rows this season, and desirable progenies will be carried on and tested against the existing strains.

Selection work on Malwa Upland cotton has been transferred to Badnawar (Dhar State) in the best Upland cotton growing district in Malwa.

At Dhar, progeny row selection has been initiated in a mass selected Malvi cotton maintained by the Agricultural Department, and in the Nimar tract of Dhar State selection in the local Nimari bulk has given an immediate improvement of considerable magnitude.

Thanks to the co-operation of the Agricultural Department, Dhar State, it has been possible to carry out the breeding work in all three of these centres by the replicated progeny row technique developed at the Institute.

Work is being started on the much-needed improvement of Rajputana Bengals. Hybrid material from a cross made in Trinidad has been sent for study in Ganganagar (North Bikaner), and a beginning has been made in the separation of longer linted components from the *desi* mixture of Jodhpur and Jaipur.

(f) *Variety Trials*.—A large number of variety trials were carried out in the period under review. The potentialities of existing selected varieties for the different tracts of Central India and Rajputana are now fairly well known, and may be summarised as follows :

(1) Black soil tracts of Central India (Malwa plateau) :

(a) Malvi 1 and Malvi 9 yield about 20 per cent more than the local mixture. Malvi 9 gins 32-34 per cent. as against about 28 per cent. in local. Malvi 9 spins about 40 per cent. higher counts than local.

(b) Cambodia yields very much less than *desi* on all types of land with the possible exception of areas irrigated from tanks, which are being further investigated. It may be said with confidence that Cambodia will not pay the cultivator in Malwa unless he receives a 50 per cent. premium for his *kapas*. The actual premium paid for Cambodia *kapas*, as ascertained from ginners and the Indore Mills, is not more than 15 per cent.

(2) *Nimar tract*.—Banilla will give the cultivator an immediate increase in return on account of its higher ginning percentage. Verum is lower yielding than the local mixture, but would pay if pooling and marketing facilities were provided.

(3) Gang Canal Colony, well and tank-irrigated sandy lands in Rajputana :

Cawnpore 520 is a definite improvement on Mollisoni in the Gang Canal Colony, and will probably pay better than local on most irrigated sandy lands. Rosea Bhatla has given very high yields in Rajputana, but is very poor in quality. It is rather doubtful whether American types have any permanent place in Rajputana.

(4) *Bundelkhand*.—The extension of cotton in this tract would be of very doubtful value. Yields in all trials carried out for the Institute have been extremely low owing to heavy boll shedding after untimely rains, and Pink bollworm attack. No recommendation can be made.

9. *Cotton—Physiology, Pathology and Agronomy*.—A very large amount of data of varied character has been accumulated and is being reviewed. The following summary deals with only a small fraction of it.

(a) *Bio-chemical studies on Wilt*—Indications from the previous year's work regarding root relationships were confirmed thus —

(i) In the course of root studies healthy and wilted plants were removed from the soil together with the whole of their root systems. Microscopic examination of this material is being made to trace the course of infection. This work is not finished but it has been amply confirmed that the presence of fungus in a plant does not necessarily lead to its death, or even to any wilting. On the other hand wilting followed by death occurred when no fungus could be found.

Further examination of the root systems of pairs of healthy and wilted plants again showed less root activity in diseased plants than in healthy ones. A more detailed examination is being made, some of the results of which are tabulated.

TABLE 1.—*Root activity of healthy and wilted cotton plants in relation to soil zones, 1933-34*

Average lengths in inches of active roots of Malva Cotton

(Based on root exposures of 21 plants).

Soil zones.	Healthy	Wilted	P
0-0"	37.1	15.3	< 0.01
0"-18"	17.4	5.3	< 0.05 > 0.02
18"-downwards	10.6	8.9	> 0.05

*Note*—In this and subsequent tables when P is shown as less than 0.05 the odds in favour of the validity of the result shown are 20 to 1, if less than 0.01 the odds are 100 to 1. When P is greater than 0.05 the odds are less than 20 to 1.

It seems that this weakening of root activity is located in the upper soil zones and it is from them that the plant's nutrition is chiefly derived. It appears that this is a concomitant of wilt.

(ii) Last year's observations on the periodicity of virulence were further extended and amplified. Periodicity in virulence is now established. This data is being examined in greater detail.

(iii) *Soil moisture relations and wilt*—Total and hygroscopic moistures were determined, at intervals in the field in two zones around the roots of healthy and wilted plants. Results are given in Table 2—A, B, C.

TABLE 2—*Means percentage moistures in soils around the roots of healthy and wilted cotton plants*

A. TOTAL MOISTURES.

Depth of soil	Healthy plants	Wilted plants.	Total
3"-6"	27.65	35.14	62.79
9"-12"	29.21	30.30	59.61
Total	56.86	65.44	122.3

Healthy < Wilted       $P < 0.05$ , Sig. diff. 7.21.



## B. HYGROSCOPIC MOISTURE.

Depth of soil.	Healthy plants.	Wilted plants.	Total.
3"—6"	9.7	12.9	22.6
9"—12"	11.6	10.8	22.4
Total ..	21.3	23.7	45.0

Interaction of depth with healthy and wilted plants—

Moisture values  $P < 0.05$ , Sig. diff. 2.72.

## C. RATIOS OF MEAN PERCENTAGE MOISTURES FOR TWO DEPTHS AROUND THE ROOTS OF HEALTHY AND WILTED COTTON PLANTS.

Ratio.	Healthy plants.	Wilted plants.	P.	Significant difference.
$\frac{9"-12"}{3"-6"}$	1.05	0.90	$< 0.05$	0.14

The moisture contents around wilted plants were higher than around healthy plants (A). Ratios of moisture contents in the lower zones to those in the higher zones were greater than unity and higher for healthy plants than for wilted plants for which the ratios were less than unity (C).

The hygroscopic moistures of the upper soil zones were higher around wilted plants than healthy ones (B).

The physical condition of soil around healthy plants seems to permit a greater percolation of water to lower depths and conversely the upper zones around wilted plants are charged with larger amounts of water because the soil has become less permeable (as indicated by the higher hygroscopic moisture of those zones). The influence of this on root aeration is clear. The reduced activity actually found in the upper portions of the root systems of wilted plants mentioned above corroborates these observations.

Leaf samples from healthy and wilted plants were collected and are awaiting analysis, to locate the changes in the metabolism of the plants brought about by reduced root activity.

(iv) *Nutrition and cotton wilt.*—Another line of investigation started in 1933 was as follows:—

Soils both in pots (1933 and 1934) and in the field (1934) were treated with—

- (i) inorganic nutrients in different proportions,
- (ii) manures of widely different compositions and properties and
- (iii) dressings of substances calculated to effect a physical improvement of the soil.

The soils were inoculated with vigorous cultures of the fungus and sown with Malvi cotton. Repeated inoculations were made to ensure active infection throughout the period of observations. The identical soils in pots of the 1933 experiments were given the same treatments in 1934.

Different degrees of virulence were observed in different treatments in fields and pot cultures. Some of the results are given below.

TABLE 3—*Effect of nutrients on incidents of Wilt.*

Treatments	1933-34	1934-35	Increase in death % in 1934-35 over 1933-34.
1. N. ( $\text{NH}_4$ & $\text{NO}_3$ ) Ratio ammoniacal N to nitrate N 1:1. .. ..	50.0	100.0	+ 50.0
2. N + $\text{P}_2\text{O}_5$ .. ..	50.0	91.7	+ 41.7
3. $\text{K}_2\text{O}$ + $\text{P}_2\text{O}_5$ (1:1) .. ..	25.0	80.0	+ 55.0
4. $\text{CaO}$ .. ..	16.7	65.2	+ 48.5
5. $\text{K}_2\text{O}$ + $\text{P}_2\text{O}_5$ ( $\frac{1}{2}$ :1) .. ..	8.3	41.6	+ 33.3
6. $\text{K}_2\text{O}$ + $\text{P}_2\text{O}_5$ (1: $\frac{1}{2}$ ) .. ..	8.3	33.3	+ 25.0
7. $\text{MgO}$ .. ..	0.0	49.2	+ 49.2
8. Compost .. ..	0.0	29.2	+ 29.2
9. Glue .. ..	0.0	19.2	+ 19.2
10. Farm Yard manure .. ..	50.0	42.8	— 7.2
11. Control .. ..	19.4	12.2	— 7.2
P. .. ..	<.05	<.05	
Sig. diff. .. ..	27.2	30.8	

Salts used were ammonium nitrate for N, Potassium sulphate for  $\text{K}_2\text{O}$ , Sodium phosphate for  $\text{P}_2\text{O}_5$

In the series with added nutrients, the same relative differences were observed successively for two years. Some treatments have increased and others have decreased the virulence. In 1933 the highest virulence was induced by nitrogen alone, and with phosphate; it increased considerably in 1934. Potash with phosphate (1:1) in 1933 did not increase virulence significantly but in 1934 this treatment reached the level, in this respect, of the nitrogen alone and with phosphate.

When the ratio of potash and phosphate was altered in either direction the increase of virulence in 1934 did not reach significance, though reduction in potash nearly did so.

Magnesia and lime did not differ from control in 1933 but gave a significant rise in virulence in 1934 of the same order as potash and phosphate ( $\frac{1}{2}$ :1).

Compost and glue in both years showed no significant difference from farm yard manure and control, though the first pair showed a numerical rise in virulence in 1934 and the second pair a fall.

An excessive supply of nitrogen seems to be very powerful in increasing susceptibility. A study of the cumulative effect of several treatments is perhaps likely to give further information, as to the nature of the balance between soil components which determines resistance or susceptibility.

(v) *The yield of cotton as influenced by wilt incidence*—In order to discover whether in an infected soil an invisible attack on apparently healthy plants could be traced from a measure of their yield vigour, plant yields of *kapas* were recorded in 1933 and 1934 for apparently healthy plants growing in apparently wilt infected and uninfected field patches. These were compared with yields of wilted plants, both dead and showing fresh growth. The average yields per plant are tabulated with a statement of significances of their differences in Table 4. These observations were taken from time to time over the harvest period on plants surviving to the bearing stage. The yield is seriously depressed by wilting, whether the plant dies or survives to grow later. The differences between yields of healthy plants from affected and unaffected patches were not significant, but it is yet to be seen whether they would be significant when compared picking by picking.

TABLE NO. 4.—*Influence of 'Will' on cotton yield.*

KAPAS, GMS. PER PLANT.

Healthy plants.				Mean yield.	Comparison	N.	T.	P.
A.	From unaffected patches	..	..	17.05	A Vs. B.	47	1.7	>.05
B.	From affected patches	..	..	12.0	A Vs. C.	45	4.89	<.01
					A Vs. D.	40	4.48	<.01
	Wilted plants.				B Vs. C.	54	4.7	<.01
C.	Dead	..	..	4.3	B Vs. D.	49	4.3	<.01
D.	Resumed fresh growth	..	..	4.2	C Vs. D.	47	.009	>.05

(b) Cotton nutrition in relation to environment :

(Yield)

(i) Soil type. The influence of sowing date on yield was reported last year ; that of soil type was then investigated in lysimeters filled with field soil, zone by zone, as it exists in nature. The soils used were :

- (1) Jaipur sandy soil.
- (2) Soil of the Badnawar tank areas in Dhar State (noted for good Cambodia cotton).
- (3) Black soil well-drained but shallow (about 2 to 3 feet) from Institute Field 31.
- (4) Light grey-coloured, deep soil (about 15 feet), well-drained, from Institute Field 40.

In 1933 Cambodia (Indore 1) and Malvi (No. 9) cotton were sown, no manure was given and after the monsoon rain-water was applied as required ; hence the intrinsic differences in productivity and varietal suitability of the soils were the only operating factors. The relative exhaustion of these soils by the cotton crop was measured by growing a second crop of the same varieties in 1934. Again no manure was given nor any water after the cessation of rains which were exceptionally copious.

In this and the next three experiments, which were in the nature of " feelers," the data given in Tables 5 to 9 are not capable of statistical examination.

TABLE 5.—*Calculated yield of seed cotton in gms. per 100 sq. ft. in Lysimeters—1933 and 1934.*

Variety.				Soil 1.		Soil 2.		Soil 3.		Soil 4.	
				1933	1934	1933	1934	1933	1934	1933	1934
Indore 1	..	..		289	15	1332	113	110	0	237	7
Malvi 9	..	..		449	218	1194	250	212	169	431	232

In 1933, soil 4 yielded more than soil 3 but slightly less than soil 1—Soil 2 stands by itself. In general there was a great fall in yield in 1934—much more than was to be expected from seasonal variation. This fall is greater for Cambodia than Malvi which yielded 20 per cent, 46 per cent, 51 per cent and 79 per cent. less in soils 3, 4, 1 and 2 respectively. Soil 2 (Badnawar) comes from the seepage areas of tanks and these soils are heavily manured. The Cambodia crop in Jaipur is also heavily manured and then yields almost as well as at Badnawar. The successful cultivation of cotton on the same land year after year practised at Badnawar seems to depend, therefore, on the very heavy manuring given—a

custom inherited from the opium crop practice by its present successor. The deterioration of this soil through one crop of cotton is more serious than that of ordinary black cotton soils and it is questionable how for the current practice is sound.

(ii) *Humus supply*—It was reported in 1934 that yields of Malvi increased when manure was applied to the whole profile, in strong contrast with the insignificant yield differences from field crops surface dressed.

Cotton—Cambodia (Indore 1) and Malvi (No 9) was grown in the same manured profile plots in 1934 to ascertain the continuity of the effect of profile application with the following results —

TABLE 6—*Calculated yields of seed cotton in gms per 100 sq ft in manured profile plots, 1933 and 1934*

Treatment	Malvi 9		Indore 1 1934
	1933	1934	
No treatment	1170	656	165
Farm Compost	2167	1396	749
Farm Yard Manure	1886	916	615
Municipal Compost	2376	1192	547

In 1933 manures were mixed throughout the profile down to murum—18 24 inches in depth. In 1934 they were given as surface dressings at 10 tons per acre.

Because of a difference in plant spacings the yields for the two years should not be compared together but the order of productive capacity of treatment may be contrasted.

The 1934 manured yields are so much higher than the control that the effect of profile manuring in 1933 can be assumed to have been continued. It is noteworthy that farm compost and municipal compost (with its higher phosphate content) have changed places in 1934 and the superiority of Malvi over Cambodia on black cotton soils both manured and unmanured is clearly indicated.

(iii) *Soil texture*—The influence of open surface texture reported last year was tested for residual effect, a cotton crop being sown again on the same plots with the following results —

TABLE 7—*Soil texture and cotton yield—1933 and 1934. Calculated yields of seed cotton in gms per 100 sq ft*

Unmanured				Manured		
Variety	Control	Heated soil		Control	Heated soil	
		6" surface layer	50% in 6" surface layer		6" surface layer	50% in 6" surface layer
Year 1933						
Indore 1	221	456	608	277	762	955
Malvi 9	658	1164	801	910	1399	1174
Year 1934						
Indore 1	163	26	123	143	115	68
Malvi 9	215	375	347	232	222	144

In 1933, in unmanured plots, the 50 per cent. heated soil treatment gave the highest yield with Cambodia, and the full 6 inches layer treatment with Malvi. The response to manures for Cambodia was considerably higher in the plots treated with heated soil than in the control. Malvi responded to manure better than Cambodia on untreated plots but when the plots were treated with heated soil the percentage increase of Malvi due to manure was less than that of Cambodia, and also less than its percentage increase in response to manure on untreated soils. But the absolute yields are still highest for the treated plots, the full 6-inch layer (with manure) being the best. This seems to indicate that the very open texture induced by the 6-inch layer of heated soil influences Malvi yields in the same way and to a greater extent than does manuring. With Cambodia, however, open texture was an essential factor for any increase in yield with or without manures.

All yields fell in 1934, but the fall was least with Cambodia in the untreated plot without manure. The greatest exhaustion took place in manured plots except for one plot with a 6-inch layer treatment. The degree of exhaustion is not strictly parallel to the yields of 1933 probably because of the varying degree of subsequent recuperation. Manure has partially compensated for the exhaustion of the full 6 in. layer plot. The net yields are, however, highest in controls in 1934. Malvi also shows a similar exhaustion—more than Cambodia in the control plot—and the differences due to heated soil treatment or manuring are slight. Malvi shows a better response to heated soil treatment without manures than does Cambodia. The greater responses in 1933 of Cambodia to 50 per cent. heated soil and of Malvi to the full dressing probably indicate the reaction of their root-systems to the balance maintained between moisture and aeration due to the treatments in their active zones. The favourable influence of the manured profiles is however the same for both varieties, showing clearly the superiority of humus in raising yields. It is also evident that about six inches depth of soil of open texture brings a higher response to manures.

(iv) *Nutrients*.—In spite of negative results from field trials in 1931 and 1932, the results set out above clearly indicated the possibility of a favourable response to manures under certain soil conditions. A qualitative test was made in 1933 in pot-cultures to find what nutrients were most likely to induce response. The 92 pots were filled with uniformly graded surface soil treated in bulk with their respective nutrients. The experiment was done in duplicate with Cambodia (Indore 1) and Malvi 9 cotton.

In 1934 another experiment was made with four replications using 192 pots, to test the effect of the more promising nutrients upon soils treated to bring about differences of texture by flocculation.

The results are shown in Table 8, A to F.

TABLE 8.—*Differences in response of Cambodia, Indore 1 and Malvi 9 to nutrients.*

A.—MAXIMUM RESPONSE—1933 EXPT.

Influence on	Indore 1.			Malvi 9.		
	Treatment.	Control.	Wts. or hts. max.	Treatment.	Control.	Wts. or hts. max.
Yield of <i>kapas</i>	am. sulph. in 2 doses	1.2	21.2	am. sulph. + di-sod. hyd. phosph.	2.0	19.3
Plant weight after 43 days.	am. sulph. + di-sod. hyd. phosph. + pot. sulph. 1 dose.	2.7	13.0	am. sulph. + di-sod. hyd. phosph. + pot. sulph. 1 dose.	1.8	7.2
Final height after 133 days.	am. sulph. in 2 doses.	9.75	19.5	am. sulph. + di-sod. hyd. phosph. in 1 dose.	11.0	44.25

## B—DEPRESSING INFLUENCES OF TREATMENTS

Depression in	Treatments	
	Indore 1	Malvi 9
Yield of <i>kapas</i>	Nil	am sulph 1 dose
Plant weight at 43 days	am sulph + pot sulph 2 doses Pot sulph 1 dose and 2 doses sod nitrate 2 doses	Sod nitrate 1 dose pot sulph 2 doses di sod hyd phosph 1 dose am sulph 2 doses
Final height	Di sod hyd phosph 1 dose and 2 doses pot sulph 2 doses	Pot sulph 1 dose

## C—MODIFYING INFLUENCE OF COMPONENTS OTHER THAN THE NUTRIENT ELEMENTS

	Yield		Plant weight		Final height	
	Indore 1	Malvi 9	Indore 1	Malvi 9	Indore 1	Malvi 9
<i>Nitrogen alone</i>						
am sulph 1 dose	9 1	1 7	6 0	1 4	13 75	23 0
sod nitrate 1 dose	8 3	4 6	5 7	1 6	14 5	21 5
calc nitrate 1 dose	8 7	11 85	3 9	2 4	14 5	34 0
<i>Phosphates alone</i>						
di sod hyd phosph 1 dose	5 3	6 45	3 8	1 2	8 5	13 5
super phosph 1 dose	7 8	8 0	2 9	2 1	13 5	18 0
am sulph + di sod hyd phosph 1 dose	7 2	19 3	7 0	5 4	11 5	44 25
<i>Nitrogen plus phosphate</i>						
am sulph + di sod hyd phosph 1 dose	7 2	19 3	7 0	5 4	11 5	44 25
Nicifos 17/45	12 5	16 25	3 3	3 4	15 25	29 0
Nicifos 22/18	11 9	11 20	10 1	2 2	12 5	18 0

## D—INFLUENCE OF ONE NUTRIENT ELEMENT ON ANOTHER

	Yield		Plant weight		Final height	
	Indore 1	Malvi 9	Indore 1	Malvi 9	Indore 1	Malvi 9
am sulph + di sod hyd phosph 1 dose	7 2	19 3	7 0	5 4	11 5	44 25
am sulph + pot sulph 1 dose	4 90	4 0	6 6	3 1	13 0	18 5
am sulph + pot sulph + di sod hyd phosph. 1 dose	14 1	3 9	13 0	7 2	14 5	30 0

## E.—COMPLETE NUTRIENT IN DIFFERENT FORMS AND WITH DIFFERENT RATIOS NK :

P<sub>2</sub>O<sub>5</sub>.

	Ratio.	Yield.		Plant weight.		Final height.	
		N: K <sub>2</sub> O: P <sub>2</sub> O <sub>5</sub> .	In- dore 1.	Malvi 9.	In- dore 1.	Malvi 9.	In- dore 1.
Safflower cake .. ..	1:0.33:0.66	17.0	..	6.4	3.5	14.0	..
Municipal compost ..	1: 1.4 : 1.7	11.0	14.6	5.4	3.5	11.0	22.25
Farm compost .. ..	1: 3.4 : 0.58	6.5	6.10	6.4	2.1	10.0	18.0
Farm yard manure ..	1: 3.9 : 1.7	5.6	7.3	4.2	2.9	14.5	16.0

## F.—MODE OF APPLICATION, ONE AND TWO DOSES.

			Yield.		Plant weight.		Final height.	
			In-dore 1.	Malvi 9.	In-dore 1.	Malvi 9.	In-dore 1.	Malvi 9.
am. sulph.	1 dose	..	9.1	1.7	6.0	1.4	13.75	23.0
	2 doses	..	21.2	14.4	3.6	1.7	19.5	25.0
sod. nitrate	1 dose	..	8.3	4.6	5.7	1.6	14.5	21.5
	2 doses	..	11.4	7.2	2.1	2.6	13.0	16.75
di-sod. hyd. phosph.	1 dose	..	5.3	6.45	3.8	1.2	8.5	13.5
	2 doses	..	4.20	3.0	2.8	3.8	9.0	11.5
am. sulph. + di-sod. hyd. phosph.	1 dose	..	7.2	19.3	7.0	5.4	11.5	44.25
	2 doses	..	7.7	7.7	10.3	2.2	15.5	25.5
pot. sulph.	1 dose	..	4.97	4.40	2.1	2.6	14.0	10.5
	2 doses	..	6.0	5.5	8.25	1.2	8.25	13.0
am. sulph. + pot. sulph. + di-sod. hyd. phosph.	1 dose	..	14.1	3.9	13.0	7.2	14.5	30.0
	2 doses	..	6.6	13.75	6.5	6.0	15.25	31.75
am. sulph. + pot. sulph.	1 dose	..	4.90	4.0	6.6	3.1	13.0	18.5
	2 doses	..	3.15	6.10	2.4	3.9	12.5	16.0

The following points were brought out by these pot-cultures:—

(1) The greatest plant weights for both varieties within a period of 43 days from germination were produced by complete nutrients given in one dose.

(2) Maximum *kapas* yields of Cambodia however were given with ammonium sulphate in two doses and of Malvi 9 with a mixture of ammonium sulphate and di-sodium-hydrogen-phosphate in one dose.

(3) Maximum heights were given by those treatments which gave maximum yields.

(4) The yield of Cambodia was increased by all treatments. Ammonium sulphate in one dose, however, depressed it for Malvi 9.

(5) Plant weights at 43 days and final heights were lower than control with some treatments

(6) Nutrients applied in different combinations gave different results the varieties not always responding in the same way Practically equal responses were obtained from treatments differing in the preponderant nutrient elements Single nutrients sometimes gave the same result as that from a combination

Absolute values (plant weight) for the early start or the final growth (height) do not show any consistent relation to the total yield The effect of nitrogen is influenced by the presence or absence of other elements (potash and phosphorus) The combination of nitrogen and phosphorus had a beneficial effect on Malvi 9 and to a certain extent on Cambodia Different ratios between elements supplied in the same form have different effects but such different effects can also be produced by nutrients in the same ratio but in different forms

For both the varieties the application of nitrogen and in some degree potash in two doses is better than in one dose but two applications of phosphorus have the reverse effect Combinations of nitrogen and potash and nitrogen phosphate and potash gave better results with Cambodia when applied in a single dose but with Malvi 9 it was the reverse Nitrogen and phosphorus are better in one dose combined on Malvi 9 but on Indore 1 there is no difference between one and two doses

An effective system of manuring will have to be based upon the correct intensity of nutrient supply especially of nitrogen and to a less extent phosphorus in the early and later stages of growth

The effect of the unabsorbed residues of the chemicals used (bases acids etc) is known to be indirect through their modifying influence on the physical condition of soil hence it seemed necessary to determine the soil texture suitable for the utilisation of the nutrients

The results of the 1934 experiment which was intended to give further information in this direction are tabulated below

TABLE 9—*Texture differences and nutrient efficiencies for cotton 1934 35*

Yield of seed cotton and plant weights are given in gms per plant and heights in inches

A—INDORE 1

Treatment	No Treatment			Compost			Acid			Compost+Acid		
	Yield Kapas	Final plant weight	Final plant height	Yield Kapas	Final plant weight	Final plant height	Yield Kapas	Final plant weight	Final plant height	Yield Kapas	Final plant weight	Final plant height
Nd	3.5	9.0	7.6	4.9	14.8	14.9	2.8	5.8	3.9	8.7	25.4	14.7
N	4.8	7.0	7.8	14.0	40.3	22.5	4.6	14.0	10.0	8.9	27.1	16.6
P	10.7	68.0	12.3	6.8	21.0	15.3	2.5	7.0	6.4	4.9	8.8	10.4
K	7.7	15.0	14.8	10.2	75.2	20.3	6.3	9.0	9.9	6.6	10.5	13.9
NP	15.6	41.9	29.2	18.7	93.6	26.4	7.0	13.1	14.1	7.8	15.7	14.2
NK	8.6	19.8	20.4	13.7	86.0	24.7	0.6	4.4	14.2	11.7	33.8	20.4

B—MALVI 9

Nd	2.8	5.2	13.0	6.3	13.1	32.4	1.3	1.7	16.1	5.9	26.2	33.5
N	3.2	28.8	11.0	13.9	15.1	66.7	4.0	10.0	20.7	12.1	32.3	38.7
P	2.7	16.7	21.2	6.3	25.2	36.6	1.3	4.0	12.5	3.8	8.7	24.6
K	2.3	4.2	15.0	9.9	25.3	31.2	5.4	20.1	10.9	5.6	24.6	31.1
NP	15.2	77.8	52.2	12.7	57.7	59.3	7.2	13.3	29.9	8.7	19.2	38.4
NK	3.9	23.6	38.8	13.4	64.0	50.7	3.2	7.0	17.0	6.8	61.2	49.4



## SIGNIFICANCES.

TREATMENTS.											P.
Texture	..	..	..	..	..	..	..	..	..	..	< 0.01
N & No N	..	..	..	..	..	..	..	..	..	..	< 0.01
K & P ..	..	..	..	..	..	..	..	..	..	..	< 0.01

## INTERACTIONS.

(N & No N) × (K & P)	..	..	..	..	..	..	..	..	..	..	< 0.01
Texture × (N & No N)	..	..	..	..	..	..	..	..	..	..	< 0.05
Texture × (K & P)	..	..	..	..	..	..	..	..	..	..	< 0.01
Texture × (N & No N) × (K & P) ..	..	..	..	..	..	..	..	..	..	..	< 0.01
Varieties × Texture	..	..	..	..	..	..	..	..	..	..	< 0.05
Varieties × (K & P)	..	..	..	..	..	..	..	..	..	..	< 0.05
*Varieties × Texture × (N & No N) × (K & P) ..	..	..	..	..	..	..	..	..	..	..	< 0.01

\* Sig. diff.=2.4 for mean yield of *kapas* per plant.

The clues given by the qualitative experiment of 1933 were amply confirmed. Cambodia showed a capacity to yield higher than Malvi 9. The highest yields of Cambodia were obtained in the presence of compost, supplemented either by potash alone or a mixture of nitrogen and potash; while Malvi 9 yielded its highest with nitrogen and phosphate in the absence of compost.

Several other points bearing upon cotton nutrition have been brought into relief.

## CAMBODIA COTTON.

(i) *Behaviour with nitrogen.* On ordinary black soil this nutrient has no appreciable effect and acid flocculation or combination with potash makes no difference but when combined with phosphate or with compost the yield is raised nearly three times. The addition of compost to the combination of nitrogen and potash gives a similar increase and addition of compost to nitrogen and phosphate leads to a still higher increase in yield. This favourable effect of compost on nitrogen alone and with phosphate and potash is reduced by acid flocculation. There is no difference between the single effect of compost and of nitrogen but acid flocculation with compost treatment nearly doubles the yield in contrast with its effect on nitrogen. In the absence of compost, flocculation of soil reduces the yield by nearly one-third.

It is obvious that compost plays two roles (1) its physical influence on the soil, (2) its supply of nitrogen, phosphate and potash or their combinations according to requirements; a sort of balancing agent, preventing excess or deficiency of any one nutrient.

(ii) *Behaviour with potash and phosphate.*—The response to potash is higher than to nitrogen but lower than to phosphate. The addition of compost, however, to phosphate reduces the yield by one-third, but when added to potash yield is increased by nearly two and half times.

(iii) Flocculation by acid does not influence the response to potash in the absence of compost but prevents any benefit being derived from it. This is comparable to the similar effect of acid flocculation on compost-treated soils mentioned above, preventing them from deriving any benefit from added nutrients, presumably because of the nature of the flocculation induced by acid contrasted with humic flocculation. This may be taken as an indication that the Cambodia crop with an adequate supply of nutrients demands a moisture supply free from the greater fluctuations resulting from acid flocculation.

## MALVI (No. 9) COTTON.

(i) Nitrogen has no influence on yield and flocculation by acid or the addition of potash makes little difference, but in combination with phosphate the yields almost become five-fold and reach the maximum for the variety. Compost gives nearly twice as much yield as nitrogen but a combination of compost with nitrogen raises the yield to four times that from nitrogen alone.

(ii) Like nitrogen, potash and phosphate alone had no influence on yield.

(iii) Flocculation by acids has no influence except in the presence of nitrogen and phosphate together or potash alone. Compost however reduces the response to nitrogen plus phosphate by 20 per cent. and with acid flocculation the yield is further reduced by 25 per cent. to the level of yields from acid alone. In combination with nitrogen acid flocculation raises the yield one-and-a-half times but further addition of compost to the combination gives further increase to three times.

This probably indicates that any favourable influence of compost on Malvi 9 is through its power to supply nutrient and not so much to its effect upon moisture relation.

It appears that the conditions produced by compost in presence of all added nutrients are favourable for Cambodia but definitely unfavourable for Malvi, when the added nutrient is a combination of nitrogen and phosphate.

If the drying effect of compost alone on the soil is assumed to be less powerful on the soil than that of acid flocculation, it may be concluded that compost keeps the moisture at adequate levels except when, as with Malvi 9 treated with nitrogen and phosphate, the demand becomes too high.

TABLE 10.—Influence of green manure on the yields of wheat and cotton at Indore.

Variety—Malvi 1.

Yield in lbs. per acre.

Yield of	Green manures cut and removed				Green manures ploughed in						Significant difference.
	Black gram.	Sann.	Soya-beans.	Cow-peas.	Black gram.	Sann.	Soya-beans.	Cow-peas.	Fallow.	P.	
Total yield :—											
Wheat, 1932 ..	635	577	472	597	604	559	554	479	475	< 0.05	104
Cotton, 1933 ..	540	522	517	547	583	528	566	486	442	> 0.05	—
Yield of two pickings of cotton (1st & 2nd) ..	281	267	243	263	291	254	254	245	172	< 0.05	54

## V.—HUMUS SUPPLY (FIELD SCALE).

Some of the investigations described in paras (i) to (iv) above have also been studied under field conditions—the results are summarised below under the same headings. Green manuring followed by wheat in the same year and subsequently by cotton gave higher total yields with wheat but not significantly with cotton, though the first two pickings yielded better with green manure. The rainfall was very heavy (51.82 inches) and it is possible that in normal years increases may also be obtained with total yields (Table 10).

## VI.—SOIL TEXTURE.

Both Malvi 9 and Cambodia Indore 1 did not respond significantly to field applications of heated soil at five or twenty cartloads per acre. The doses were much smaller than those used for the small plots mentioned above. A test is being made to find the effect of heavier applications within the range of practicability.

Similarly, in another field test flocculation by sulphuric acid gave no yield differences even when repeated twice during the crop period. Superphosphate behaved similarly.

The steady maintenance of favourable moisture conditions resulting from open texture cannot be brought about in Indore soils by mechanical means to ensure good drainage conditions. An experiment repeated for three years consistently gave no significant differences in yields when attempts were made to keep open texture by providing shallow furrows at different intervals between rows of the growing crop to regulate drainage and soil aeration.

In the last three years very heavy rains spoiled several field experiments aimed at estimating the influence on the yields of cotton and other crops of:—

- (1) Previous crop.
- (2) Interculture to keep mulches of different depths.
- (3) Weeding.
- (4) Intersowing of other crops.

The last year's experiment shows a significant detrimental influence due to absence of weeding even when the rains have depressed the yields of the cotton crop to the lowest limit.

TABLE 11.—*Response of common crops to interculture and weeding, 1932-34.*

Yields in lbs. per acre.

## A. CROP—COTTON.

Year.	Hand weeding only.	Indore ridger and weeding.	Daura & weeding.	Guntaka & weeding.	P.	Significant difference.
1932 .. ..	265	270	225	248	> 0.05	—
1934 .. ..	229	282	312	254	> 0.05	—

B. CROP—JOWAR (*Sorghum*).

1932.								
Grain	..	..	149	148	251	216	<0.05	48
Kadbi *	..	..	4,340	4,300	4,280	3,900	<0.05	497
1934.								
Grain	..	..	373	352	409	368	> 0.05	—
Kadbi	..	..	1,897	2,068	2,166	1,971	> 0.05	—

\* Dry stems and leaves.

C. CROP—TUR (*Cajanus indicus*—pigeon pea)

Year	Hand weeding only	Indore ridger and weeding	Daura and weeding	Guntaka and weeding	P	Significant difference
1933						
Grain	685	615	660	670	> 0.05	—
Bhusa*	530	483	553	560	> 0.05	—

\* Straw and chaff

## D CROP—COWPEAS

1933						
Grain	135	116	146	130	> 0.05	—

## E CROP—WHEAT

1933						
Grain	330	343	251	228	> 0.05	—
Bhusa	492	555	464	451	> 0.05	—

## F—INFLUENCE OF INTERCULTURE AND WEEDING ON COTTON (1933) VARIETY—MALVI BULK—LB PER ACRE

Ridger and weeding	Ridger no weeding	Daura and weeding	Daura no weeding	Weeding alone	No weeding	P	Sig diff
105.2	10.4	86.4	2.1	60.1	3.1	< 0.05	50.4

Shallow interculture either by Daura or Guntaka benefitted the jowar crop in 1933. This seems to be due more to the effective weeding done by these implements than to their capacity to produce a mulch. This has been confirmed by the results of another experiment in 1933.

TABLE 12—Yield and growth of jowar as influenced by weeding and interculture

Yields in lb per acre

1933

VARIETY—JOWAR MALVI

	Ridger		Daura		No interculture			Sig diff
	Weeding	No weeding	Weeding	No weeding	Weeding	No weeding	P	
Grain	181	161	137	100	198	59	< 0.05	43.7
Kadbi ..	1,934	1,559	2,259	2,125	2,334	1,950	< 0.05	407.8

The extreme importance of weeding is clear. The favourable influence of implements wherever it exists was solely due to their efficiency as weeders. A deeper mulch ("Indore ridger") without weeding shows a detrimental effect presumably due to competition for moisture between the crop and the weeds not removed by the implement.

The influence of cultivation during the cold weather on the crops of the following season has been studied since 1932. The types of cultivation compared were :—

- (1) Opening the soil surface to about three inches, *desi* plough,
- (2) Subsoiling,
- (3) Soil inversion—Ransome's CT 2 plough, and
- (4) Subsoiling followed by opening the soil surface with the *desi* plough.

The experiment has not yet run sufficiently long to show cumulative effects. Heavy rains in the last two years have depressed the cotton crop.

TABLE 13.—*Yield response of common crops to winter cultivation.*

Yield—in lb. per acre.

A. CROP—COTTON.

Year.	No cold weather cultivation.	Country plough.	Sub-soiler.	Inversion plough.	Sub-soiler & country plough.	P.	Sig. diff.
1932.. ..	160	108	138	140	148	> 0.05	—
1934.. ..	51	47	72	49	49	> 0.05	—

B. CROP—JOWAR.

1932 Chari* ..	17,430	17,310	16,310	17,110	19,450	> 0.05	—
1934. Grain ..	319	204	335	218	263	> 0.05	—

\* The whole crop cut green.

C. CROP—GROUNDNUT.

1933. Nuts ..	418	354	423	330	351	> 0.05	—
Bhusa ..	700	655	722	563	608	> 0.05	—

D. CROP—COWPEAS.

1933. Grain ..	95	79	106	80	83	> 0.05	—
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## E CROP—WHEAT

Year	No cold weather cultivation	Country plough	Sub-soiler	Inversion plough	Sub-soiler and country plough	P	Sig diff
1933							
Grain	646	534	692	956	22	>0 05	—
Bhusa ..	1,548	1,573	1 614	1,878	1,563	>0 05	—

So far as the results go however, there seems to be no immediate effect of any type of inter cultivation on the succeeding crop

## VII NUTRIENTS (field scale)

At Indore a complex experiment with six factors was carried out on Malvi 9 cotton in a rich field. The general cotton yields of 1934 were very low and the results obtained are naturally indicative of what may be expected in similar seasons. The following comparisons with their interactions were included —

- (1) different depths of interculture (*daura* or "Indore ridger"),
- (2) row spacings (14 and 21 inches),
- (3) artificial manure,
- (4) organic and inorganic manure (Safflower cake and Nicofos 22/18),
- (5) Units of nitrogen ( $7\frac{1}{2}$  and 15 lb per acre) and
- (6) method of application (broadcast and drilled)

TABLE 14—Response of Malvi 9 to manures—1934

Yield—lb per acre

With manures	Without manures	P	Sig diff
448	363	<0 05	40 1

Significant differences in yields were obtained only by manuring. Unless it is found otherwise in seasons of different type a great latitude seems to be available for choosing the method of interculture and the kind of manure (the differences between which were not significant). The present seed rate of twenty lb per acre could perhaps be reduced to thirteen with saving of labour and time required for sowing. The labour of application of manures can be reduced by drilling them in and an increase of about 23 per cent in yield was obtained at a cost per acre of Rs 3 2 0 with Nicofos 22/18 (at Rs 8 6-0 per cwt) and Rs 4 3 0 with safflower cake containing 2 6 per cent N (at Rs 33 per ton).

At Dhar, however, yields of Malvi cotton were depressed by safflower cake while the higher yields obtained from Nicifos (22/18) though high enough to be significant to cake were not quite significantly different from control. This experiment was located on shallow eroded soil on the lower slope of a hill and hence liable to severe run-off. Under such condition the utility of manure is not likely to be great.

With Cambodia (bulk seed) there was an opposite result ; safflower cake gave significantly higher yields than both control and Nicifos (22/18).

TABLE 15.—Yield differences due to manures.

DHAR 1934.

lb. *kapas* per acre.

Variety.	Treatments.			P.	Sig. diff.
	Control.	Nicifos 22/18.	Safflower cake.		
Malvi bulk .. ..	630	692	541	<0.05	89.9
Cambodia bulk .. ..	403	391	474	<0.05	43.8

A similar experiment at Jaipur with Cambodia Indore 1, in addition to confirming the superiority of earlier sowings recorded in 1934 showed yield depression with Nicifos (22/18) while, as at Dhar, the higher yields of the cake treatment did not reach significance.

TABLE 16.—Sowing dates and yield of cotton.

JAIPUR 1934.

Variety Cambodia Indore 1.	April.	May.	Rains.	P.	Sig. diff.
Yield in lb. <i>kapas</i> per acre ..	982	681	309	<0.05	188

TABLE 17.—Manure and yield of cotton.

JAIPUR 1934.

Variety Cambodia Indore 1.	Control.	Castor cake.	Nicifos 17/45.	P.	Sig. diff.
Yield in lb. <i>kapas</i> per acre ..	651	831	497	<0.05	266

The high significant difference may be due to inclusion of pre rain sown plots

It will be seen that the response of Cambodia is similar to that observed in pot cultures i.e. continued supply of nitrogen favours Cambodia while Malvi cotton responds better to a single dose of nitrogen together with phosphate the response to nutrients depends upon the soil texture and associated moisture capacities

In nitrification tests at Indore already reported in a paper\* it has been shown that nitrification of the same manure continues longer in Malwa soil than in Jaipur soil. The better response of Cambodia cotton to cake at Dhar than at Jaipur confirms this in the field

It is quite clear from the foregoing field results that for the present concentration is likely to be profitable only on the investigations in cotton nutrition and manuring

*Rotation for cotton*—The experiment was started in 1932 and subsequently recast in 1933. It comprises five alternative rotations of cotton with jowar, tur, groundnut, cowpeas and wheat. Started at two points the full cycle will be complete in 1938 and will then be reported. The separate experiment—the influence on cotton of seven different preceding crops—has been completed but results are not yet examined. The cotton plots of 1934 yielded very low.

(c) *Cotton nutrition in relation to environment—Quality*—The data from pot cultures of 1934 are not yet statistically examined. They deal with the influence of soil texture, humus supply and nutrients upon the lint length and ginning percentage of Cambodia and Malvi cottons.

Similar data however from field experiments at Dhar and Jaipur are discussed below.

*Cambodia*—The influence of environment on staple length was determined on the seed cotton obtained from each treatment in the Jaipur experiment with the following results (Table 18) A to D.

TABLE 18  
Influence of environment on staple length—Jaipur 1934  
Variety—Cambodia Indore I

A

Mean staple length in mm

Sowing dates	Manure				No manure	
	Castor cake		Nisfos 17/45		Plant spacing	
	Plant spacings				12 in	18 in
	12 in	18 in	12 in	18 in		
April	25 6	21 8	24 8	24 2	22 3	22 0
May	24 8	24 8	24 5	23 0	23 5	23 0
On rains	23 0	22 7	26 3	24 7	24 0	25 5

\* Nitrogen balance in Black soils III Wad Y D and Aurangabad R I Report Proc Ind Sci Cong 93 (in publication)



Rates of manures applied : 21 lb. of N. per acre, *i.e.*, 6 cwt. of castor cake (N=3%) or 150 lb. of Nicifos 17/45 per acre.

*Significances.*

Treatment.						P.	Sig. diff. for the mean.
Sowing dates	..	..	..	..	..	<0.01	
Manure v. no manure	..	..	..	..	..	<0.05	
Spacings	..	..	..	..	..	<0.05	
B — Sowing dates × (manure v. no manure)	..					<0.01	0.35
C — Sowing dates × (cake v. Nicifos 17/45)	..					<0.01	1.50
D — (Manure v. no manure) × Spacing	..					<0.05	1.20

B

Mean staple length in mm.

Sowing dates × (manured v. unmanured).

Manured.			Unmanured.		
April.	May.	Rains.	April.	May.	Rains.
24.1	24.3	24.3	22.5	23.2	25.2

C

Sowing dates × quality of manure.

Castor cake.			Nicifos 17/45.		
April.	May.	Rains.	April.	May.	Rains.
23.7	24.8	23.2	24.5	23.8	25.5

D

(Manured v. unmanured) × plant spacings.

Manured.		Unmanured.	
Plant spacings.		Plant spacings.	
12 inches.	18 inches.	12 inches.	18 inches.
24.9	23.5	23.6	23.7

The use of manure has maintained a steadier and higher level at almost all sowing dates, closer spacing nearly always giving a longer staple. Without manure staple length diminished with each earlier sowing equally for both spacings. Rain sown crops with Nicifos or no manure gave higher lengths. The kind of manure had different effects at different sowing dates.

Castor cake gave a longer staple on the May sown crop than that sown on rains but Nicifos raised the staple length of rain sown cotton to the highest level in the trial.

Considering the following points —

- (1) the rates of nitrification of inorganic and organic manures,
- (2) the differences in moisture in hot weather and monsoon,
- (3) the higher rate of nitrification in hot weather and
- (4) the differences in evaporation of soil moisture due to spacing during the boll developing stage *ie*, after the rains cease it appears that an ample supply of nitrogen with sufficient moisture in the early stages has a favourable influence on staple length.

The results obtained on staple length of the Cambodia crop in the Dhar experiment are given below.

TABLE 19

*Influence of environment on staple length—Dhar, 1934*

Variety—Cambodia

Staple length in mm

Plant spacing	Single unit of manure *	Double unit of manure †	No manure	Mean for spacing
12 inches	19 1	20 9	19 3	19 8
18 "	18 8	18 5	18 7	18 7

#### Significance

Plant spacings— $P < 0.05$ , sig. diff. = 1.0 mm

Plant spacings  $\times$  (Cake v Nicifos 22/18)

Experimental  $Z = 0.7187$ ,  $Z$  required = 0.7205 for  $P = 0.05$

The crop was poor, due to the effect of heavy rain on soil already exhausted by two sugarcane ratoons, both Leaf roll and Red leaf were severe and the lint was weak. The differences due to treatments were therefore generally masked by this severe depression. In spite of this close spacing again gave longer staple and there is an indication that at close spacing, a higher rate of manuring is likely to lengthen the staple.

This also confirms the suggestion of the favourable effect of initial nitrogen supply and of soil moisture during boll development.

\* Single unit 7½ lb N per acre, *ie*, 200 lb of safflower cake (N=2.6%) or 42 lb Nicifos 22/18 per acre

† Double unit double the above quantities

The results were much more definite in the Dhar experiment with the hardier Malvi cotton. They are tabulated below:—

TABLE 20.

## A. Mean staple length in mm.

Plant spacings.	Manure.				No manure.
	Safflower cake.		Nicifos 22/18.		
	Single unit.*	Double unit.†	Single unit.	Double unit.	
12 inches ..	19.3	19.2	17.1	18.5	18.6
18     ,,     ..	19.2	19.3	16.2	19.0	16.2

## Significances.

	P.
Manure v. no manure .. .. .	<0.01
Quality of manure .. .. .	<0.01
Units of manure .. .. .	<0.05
Quality × units of manure .. .. .	<0.05
Spacings .. .. .	<0.01
B. Spacings × units of manure .. .. .	<0.01

Sig. diff. = 0.89

C. Spacings × quality × units of manure .. .. . &lt;0.01

Sig. diff. = 1.2 mm.

## B.

Mean staple length in mm. per plot.

Plant spacings × units of manure.

Plant spacing 12 inches.			Plant spacing 18 inches.		
No manure.	Single unit.	Double unit.	No manure.	Single unit.	Double unit.
18.58	18.20	18.82	16.18	17.66	19.12

\* Single unit :  $7\frac{1}{2}$  lb. N per acre, i.e., 200 lb. of safflower cake (N=2.6%) or 42 lb. Nicifos 22/18 per acre.

† Double unit : double the above quantities.

Plant spacings  $\times$  quality of manure  $\times$  units of manure

Plant spacings	Safflower cake		Nicifos 22/18	
	Single unit	Double unit	Single unit	Double unit
12 inches	19 32	19 16	17 08	18 48
18 "	19 16	19 28	16 16	18 96

When closely spaced and without manure the crop gave a staple equal to some of those given by manures but the widely spaced crop (without manure) gave the lowest lint length. Nicifos in one unit at the same wide spacing made no difference but raised it appreciably when the spacing was reduced. Cake at both rates and both spacings gave high staple lengths higher than a single unit of Nicifos at both spacings and no manure at wider spacing. The double rate of Nicifos behaved in a similar manner. Unlike its effect on the Cambodia crop at Jaipur, cake has given good results with both spacings while the effect of Nicifos increases with rate and not with spacing. It is difficult to say whether this is due to the use of Safflower cake instead of castor as at Jaipur or to the differences in variety and environment.

(d) *Cotton nutrition in relation to environment—the development of the plant*—Field experiments carried out in 1933 at Indore and several other places in Malwa and Rajputana showed the possibility of obtaining yields from rain sown cotton equal to those from summer sowings. Thus it appeared that though the greater intensity of photo-synthesis in a crop started in bright summer might be partly responsible for the high yields obtained, a crop receiving less light in the cloudy monsoon could also exhibit a similar performance under certain conditions. It was considered that a clear understanding of the interactions between photo-synthetic activity and other environmental factors might supply definite 'pointers' for work on cotton improvement suited to different local conditions.

Three varieties Malvi 9, Cambodia Indore 1 and Punjab American cotton (P 289T), were grown in the open in pots (i) in sand manured with safflower cake and complete inorganic nutrients and (ii) in black cotton soils manured with compost on an equivalent nitrogen basis.

One set was sown at the end of May and another in the beginning of July. Half the number of plants in each set was exposed after daylight to continuous illumination with one 200 watt Crompton gas filled pearl lamp per plot up to the maturing stage (end of November 1934).

Illumination for about a month produced symptoms of nutrient starvation in the plants and hence two applications of complete nutrients were given to all pots at monthly intervals. During dry weather, the pots were watered according to their observed requirements.

Total figures for all observations taken during and after the period of illumination are given in Table 21, A to C.

The records of bud-production, shedding, total yield and vegetative growth for all the varieties are discussed below:—

#### TOTAL BUD PRODUCTION.

*Malvi*.—Maximum bud production was obtained with illumination for both sowings in soil and with or without it for May-sown and cultures with other treatments, bud-production was nearly 50 per cent. less.

*Cambodia*.—Illumination doubled the production for July soil plants but did not much affect the production (high or low) of the other treatments.

*P. A. 289F*.—The total number of buds was low in general and illumination seemed to be unfavourable especially for the July soil culture.

It appears that a favourable effect equivalent to that of increased photo-synthetic activity can be produced without it when high nitrification can be maintained (whether by summer sowing or by use of sand). *Malvi* fares best with illumination and *P. A. 289F* worst with equal nitrogen supply.

*Shedding*.—With all the varieties, the changes observed were similar to those of bud-production but sometimes differed in degree.

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TABLE 21 — *Environment and the development of the cotton plant.*

## A MALVI 9.

Description.	Summer-sown (30 5 34)				Rain-sown (4 7 34)			
	Soil		Sand		Soil		Sand	
	Un il lumi nated	Illumi nated	Un il lumi nated	Illumi nated	Un il lumi nated	Illumi nated	Un il lumi nated	Illumi nated
I Upto 29th November 1934								
1 Total bud production	78	144 3	152	162 3	80 5	165	78	8 5
2 Total shedding	66	103	107	106	31	77	46	66
3 Interval (days) between date of sowing and beginning of shedding	90	23	90	41	56	90	56	90
4 Period of shedding (in days)	90	159	90	140	90	56	90	56
5 Rate of shedding (per day) Item 2 by Item 4	0 62	0 65	1 2	0 75	0 34	1 4	0 44	1 0
6 Percentage of shedding on total bud production	71 8	71 3	70 4	65 3	38 5	46 7	59 0	65 0
7 Yield of <i>Kapas</i> in gms	12 6	0 3	15 3	1 1	1 8			
8 Number of mature bolls	8	0 3	12	1 3	1 5			
9 Number of green bolls present on 29 11 34	12	2	3	4	40	6	29	1
10 <i>Kapas</i> per boll in gms	1 6	1 0	1 3	0 8 5	1 2			
II From 29th November 1934 to 27th February 1935								
1 Yield of <i>Kapas</i> in gms	16 2	8 3	7 7	4 3	46 0	5 3	47 2	2 0
2 Number of mature bolls	12 7	10	7 3	9 3	40	4	22 5	2 5
3 <i>Kapas</i> per boll (gms)	1 3	0 83	1 0 5	0 46	1 15	1 32	2 09	1 16
III								
1 Total yield of <i>Kapas</i> (gms)	28 8	8 6	23 0	5 4	47 8	5 3	47 2	2 0
2 Total number of mature bolls	20 7	10 3	19 3	10 6	41 6	4	22 5	2 5
3 <i>Kapas</i> per boll (gms)	1 4	0 8	1 2	0 5	1 15	1 3	2 1	1 2
IV Vegetative growth								
1 Shoot length per bud in inches	2 6	1 9	2 1	1 8	3 0	2 1	2 6	2 2

TABLE 21.—*Environment and the development of the cotton plant.*

## B. CAMBODIA INDORE 1.

Description.	May-sown (30-5-34).				July-sown (4-7-34).			
	Soil.		Sand.		Soil.		Sand.	
	Un-il-lumi-nated.	Illumi-nated.	Un-il-lumi-nated.	Illumi-nated.	Un-il-lumi-nated.	Illumi-nated.	Un-il-lumi-nated.	Illumi-nated.
I. <i>Upto 29th November 1934.</i>								
1. Total bud production ..	105	123.3	136.7	108	77	126	76	63
2. Total shedding ..	91	105	108	93	66	84	58	57
3. Interval (in days) between date of sowing and beginning of shedding .. .. .	40	22	40	22	58	58	58	90
4. Period of shedding (in days) .. .. .	142	160	112	160	90	90	90	58
5. Rate of shedding (per day) Item 2 by Item 4.	0.64	0.66	0.76	0.58	0.75	0.93	0.64	0.98
6. Percentage of shedding on total bud production .. .. .	86.7	81.8	79.0	86.1	85.7	66.7	76.3	90.5
7. Yield of <i>Kapas</i> in gms.	11.6	0.7	20.9	..	..	..	..	..
8. Number of mature bolls.	4.7	0.3	7.7	..	..	..	..	..
9. Number of green bolls present on 29-11-34 ..	6	4	8	2	11	11	5	1
10. <i>Kapas</i> per boll in gms. ..	2.5	2.3	2.7	..	..	..	..	..
II. <i>From 29th November 1934 to 27th February 1935.</i>								
1. Yield of <i>Kapas</i> (gms.) ..	12.2	..	9.5	0.6	45.6	19.3	21.5	5.9
2. Number of mature bolls.	5.7	..	5.3	0.3	18	8	10	4.5
3. <i>Kapas</i> per boll (gms.) ..	2.1	..	1.8	2.0	2.5	2.4	2.15	1.3
III.								
1. Total yield of <i>Kapas</i> (gms.) .. ..	23.8	0.7	30.4	0.6	45.6	19.3	21.5	5.9
2. Total number of mature bolls .. .. .	10.1	0.3	13.0	0.3	18	8	10	4.5
3. <i>Kapas</i> per boll (gms.) ..	2.2	2.3	2.3	2.0	2.5	2.4	2.15	1.3
IV. <i>Vegetative growth.</i>								
1. Shoot-length per bud in inches .. .. .	1.8	2.1	1.9	2.3	2.8	2.9	2.1	4.2

TABLE 21 — *Environment and the development of the cotton plant*

## C. PUNJAB AMERICAN P A 289T

Description	May sown (20-5-34)				July sown (4-7-34)			
	Soil		Sand		Soil		Sand	
	Un ill lumi nated	Illumi nated.	Un ill lumi nated	Illumi nated.	Un ill lumi nated	Illumi nated.	Un ill lumi nated	Illumi nated
<b>I Up to 27th November 1934</b>								
1 Total bud production	90	81	90	81	78	32	62.5	63
2 Total shedding	61	78	70	79	47	25	31	56
3 Interval (in days) be tween date of sowing and beginning of shed ding	40	43	40	43	38	90	53	90
4 Period of shedding (in days)	142	142	142	142	90	53	90	53
5 Rate of shedding (per day) Item 2 by Item 4	0.43	0.55	0.49	0.56	0.52	0.47	0.34	0.97
6 Percentage of shedding on total bud produc tion	67.8	96.3	77.8	96.1	60.3	78.1	49.8	88.4
7 Yield of <i>Ashes</i> in gms	17.8		15.4		3.6		1.5	
8 Number of mature bolls	-		8.7		2		0.5	
9 Number of green bolls present on 27.11.34	14	1	2		10		8	
10 <i>Ashes</i> per boll in gms	2.5		1.8		1.8		3.0	
<b>II From 27th November 1934 to 27th February 1935</b>								
1 Yield of <i>Ashes</i> (gms)	22.1		5.6		3.1		18.4	
2 Number of mature boll	9		3.3		14.5		6.5	
3 <i>Ashes</i> per boll (gms.)	2.5		1.7		2.4		2.8	
<b>III</b>								
1 Total yield of <i>Ashes</i> (gms.)	5.9		21.0		38.7		19.0	
2 Total number of mature bolls	16		1.9		16.5		7.0	
3 <i>Ashes</i> per boll (gms.)	2.5		1.73		2.3		2.8	
<b>IV Vegetative Growth</b>								
1 Shoot length per bud in inches	2.1	2.7	1.7	3.3	2.8	4.0	1.2	2.5



Illumination hastened shedding in the May-sown plants of Malvi and Cambodia but delayed it in all the July sowings except Cambodia in soil. The rate of shedding in July sowings was generally higher with illumination, differing in degree according to variety.

The percentage of shedding in Malvi plants was increased by May sowing and by illumination on July sowings. It was not affected much by May sowing with Cambodia or P. A. 289F but illumination lowered it for July-sown Cambodia plants in soil but increased it greatly in P. A. 289F.

*Total yield of Kapas.*—Yields were always depressed by illumination, P. A. 289F suffering most and July-sown Cambodia the least.

The stimulating influence of light did not extend beyond bud-production.

*Shoot-length per bud.*—Shoot-length per bud was calculated by dividing the total length of all shoots as measured at the end of November by the total number of buds produced up to that time.

Illumination depressed the shoot-length per bud in Malvi but increased it for the American cottons.

July sowings with their greater initial moisture increased shoot-length per bud with both soil and sand for Malvi and Cambodia, but for P. A. 289F, it increased on soil but decreased on sand. Irrespective of variety, season and illumination, shoot-length per bud was depressed by sand wherever yields were high but not otherwise. On the other hand in either sand or soil it rose with yield of Malvi plants and fell with that of American.

There seems to be a particular shoot-length per bud optimum for high-yielding capacity, the actual value being perhaps higher, (i) for soil than for sand in the same season and, (ii) higher for Malvi than for American cottons growing under similar conditions. This suggests a probability of there being an optimum dry weight production to enable each but to reach maturity.

(e) *Crop vigour and seed quality.*—Yield differences in groundnuts (taken as a convenient indicator crop) due to localities were found associated with similar differences in oil contents. Crops from different places varying in yield and oil content showed different proportions of nuts apparently of different quality.

TABLE 22.—Yield and oil content of groundnuts grown in different localities.

Variety—Akola 10.

Locality.						Yield in lb. per acre.	% in oil.
Indore	..	..	..	..	..	1,566	49.5
Datia ..	..	..	..	..	..	3,050	49.6
Dhar ..	..	..	..	..	..	617	47.0
Bharatpur	..	..	..	..	..	483	47.2
Sitamau	..	..	..	..	..	....	43.6

The nuts from one crop were sorted into three grades and shelled. The kernels from each grade showed distinct differences in appearance—colour, plumpness, size and brightness and there were very large differences in the oil contents,

TABLE 23.—*Differences in oil content in different grades of groundnut.*

Variety	Akola 10.
Grade.	% in oil.
1st .. ..	44.6
2nd .. ..	37.2
3rd .. ..	30.3

Several replicated field trials were made in 1934 to test if such differences persisted in the succeeding crop and how differences in varietal habit and field fertility would react upon them.

Some of the results have now been examined.

TABLE 24.—*Yield vigour as influenced by seed quality.*

Mean yields in grams per plant

Grades.	Rich field.				Poor field.			
	Akola 10	Gangapuri	Spanish peanuts	Total	Akola 10	Gangapuri	Spanish peanuts.	Total.
1st grade . .	46.6	51.7	20.3	118.6	23.8	11.5	15.7	51.0
2nd ..	33.6	40.1	17.5	97.2	24.2	13.6	16.9	54.7
3rd ..	34.0	43.0	10.4	89.4	22.0	10.5	16.1	48.6
Total .	120.2	136.8	48.2	305.2	70.0	35.6	48.7	154.3

Significance (1) fields, (2) varieties, (3) grades  $P < 0.05$ .

Sig. diff. (1) 72.40, (2) 54.26, (3) 12.72.

Other results are not significant.

Irrespective of variety, high-quality seeds gave higher yields in a rich field but the lowering of yield in a poor field wiped out the differences. Spanish peanuts showed the least yield differences between grades and none between fields—this variety has yielded lowest of those tested. This shows that the difference in seed quality appreciably affects the yields of future crops except when the crop growth is extremely poor. Other observations taken but not yet examined, such as the moisture contents in the nuts and kernels at harvest, and the shelling percentage are likely to reveal how such differences are produced. The seed of a non-responsive variety like Spanish peanut, however, seems to remain un-affected. There is ground for the belief that cotton behaves in the same way as groundnuts.

(f) *Cropping power and soil characteristics.*

(i) *Similarities of different soils.*

An attempt was made to find out whether any characteristics could be found common to different soils and tending to increase the yielding power of cotton. Both different types of soil from different tracts and the same type exhibiting differences due to treatment were compared.

Profile samples were collected in the field in Dhar and Jaipur States and at Indore from Field No. 31. Those were compared among themselves and with samples taken after harvest from Cambodia cotton plots at Indore with and without heated soil treatments (50 per cent. in the top 6 inches). Determinations for hygroscopic moisture (50 per cent. humidity), total nitrogen and base exchange capacity were made.

TABLE 25.  
*Similarities of different soils.*

Description of soil.					Hygroscopic moisture % on oven-dry basis.	Total nitrogen % on oven-dry basis. (milligrams.)	Base exchange capacity milli. equivalents per 100 gms. of air-dry soil.
Dhar soil	0"-12"	..	..		6.34	40.50	49.43
	12"-24"	..	..		7.57	34.60	50.20
	24"-36"	..	..		7.20	36.70	46.26
	36"-48"	..	..		6.43	28.90	47.87
	48"-60"	..	..		7.70	23.80	50.46
Jaipur soil	0"-6"	..	..		1.31	12.7	9.55
	6"-15"	..	..		1.29	10.4	7.74
	15"-24"	..	..		2.10	10.6	11.60
	24"-36"	..	..		2.30	10.7	14.39
Heated soil treatment	0"-6"	..	..		3.46	144.00	66.22
	6"-9"	..	..		4.57	87.50	74.14
	9"-15"	..	..		5.32	86.80	72.86
	15"-21"	..	..		4.86	78.39	88.94
	21"-24"	..	..		5.01	72.00	74.28
Indore I. P. I. Field 31	0"-12"	..	..		7.75	36.00	56.89
	12"-24"	..	..		7.10	38.10	52.47
	24"-36"	..	..		7.71	28.00	58.05
	36"-48"	..	..		6.64	22.50	54.10
	48"-60"	..	..		7.48	20.20	56.64
No treatment.	0"-6"	..	..		4.75	81.00	82.16
	6"-9"	..	..		4.91	66.00	86.28
	9"-15"	..	..		6.07	88.00	81.14
	15"-18"	..	..		5.81	86.00	74.92
	18"-24"	..	..		5.59	59.00	74.70

Hygroscopic moistures were less in the upper than in the lower layers in Jaipur and Dhar soils and greatest in the upper layer of Field 31. Heated soil reduced it.

The total nitrogen content of the Jaipur and Dhar soils was higher in the upper layer but at Indore in the second layer. Heated soil raised it in the upper layer. It also seems that the base exchange capacity is lowered up to 15 ins. depth by the heated soil treatment perhaps the similar lower level in the Dhar profile is the result of similar processes as the soil type is the same.

The carbon content was less following heated soil and a Cambodia crop. It increased with manures and to a greater depth with heated soil.

The carbon nitrogen ratio was lower after a Cambodia crop than Malvi. Heated soil and manures each intensified this difference with Cambodia. The combined effect of heated soil and manure was to raise the C/N ratio and with Malvi to lower it—below nine inches more than either treatment alone. The increases observed in the C/N ratio may be presumed to be due mainly to the depletion of nitrogen by crop growth either or both by direct absorption and by its influence on soil processes.

The conductivity ratio between one-month and 24 hour water extract shows reduction to a greater depth in control plots with Cambodia than with Malvi. With each variety manure and heated soil separately increased it in upper layers but no further when together.

#### (ii) *Soil profile changes by cropping and treatments*

Profile soil samples from the experiment on the influence of open surface texture were sampled after harvest and examined (Table 20 A and B).

Hygrosopic moisture was reduced in the upper layers by heated soil, manure and by the growth of the Cambodia variety.

The total nitrogen distribution seems to show that with heated soil also with a Cambodia crop, manure penetrated more deeply. When Cambodia grew with heated soil and manure the total nitrogen figures show a general reduction indicating its greater utilization. Malvi has exhausted the nitrogen of the heated soil plots both manured and unmanured more than the corresponding untreated plots and more than the Cambodia crop under similar conditions. The exhaustion due to Cambodia is greater in the unmanured control than the corresponding manured plots but not so with Malvi.

Base exchange capacity is reduced by treatment and manures in the Cambodia plots the reduction in the surface layer being less in the manured plots with heated soil. Compared with Cambodia, Malvi shows lower values in control plots and with heated soil in the upper three inch layer. Added manure raises them throughout the profile (without heated soil). There seems to be a relationship between the base exchange values and the plot yields inverse for the preceding year (1933) and direct for the next year.

TABLE 26.  
Soil profile changes by cropping and treatments.  
A. CAMBODIA.  
UNMANURED.

HEATED SOIL.							CONTROL.						
Depths.	Hygroscopic moisture, per cent.	Nitrogen per cent.	Carbon per cent.	C/N.	Conductivity ratio.	Base exchange capacity.	Depths.	Hygroscopic moisture, per cent.	Nitrogen per cent.	Carbon per cent.	C/N.	Conductivity ratio.	Base exchange capacity.
0-6"	3.46	0.14	0.22	1.96	2.24	66.22	0-3"	5.16	0.098	0.26	2.63	1.6	82.16
6"-9"	4.56	0.09	0.25	2.92	2.06	74.14	3"-6"	4.33	0.062	0.26	4.2	1.9	80.28
9"-15"	5.32	0.087	0.13	1.05	1.78	72.86	6"-9"	4.90	0.065	0.40	6.2	2.0	81.14
15"-21"	4.86	0.078	0.25	3.22	1.78	88.94	9"-15"	6.06	0.088	0.30	3.41	2.15	74.92
21"-24"	5.01	0.072	0.25	3.33	1.83	74.28	15"-18"	5.80	0.086	0.24	2.85	1.9	74.70
							18"-24"	5.58	0.059	0.34	5.8	2.0	
MANURED.													
0-3"	4.33	0.092	0.31	3.4	2.1	67.76	0-3"	4.20	0.098	0.31	3.23	2.65	69.94
3"-15"	4.51	0.075	0.25	3.85	2.08	61.56	3"-12"	5.15	0.081	0.14	1.73	2.60	69.69
15"-21"	3.84	0.063	0.25	4.0	1.78	66.33	12"-24"	4.6	0.075	0.15	2.02	2.2	67.81
21"-24"	4.78	0.06	0.29	4.9	1.86	63.69							
B. MALVI.													
UNMANURED.													
0-3"	5.28	0.090	0.57	6.4	2.15	64.92	0-3"	5.61	0.14	0.59	4.10	1.76	69.44
3"-15"	7.29	0.061	0.46	7.14	2.38	74.48	3"-9"	5.38	0.11	0.60	5.33	2.35	71.18
15"-18"		0.084	0.69	8.23	2.00	72.44	9"-15"	5.06	0.10	0.37	3.63	2.17	68.50
18"-24"	7.88	0.067	0.39	5.86	2.09	78.52	15"-18"	5.84	0.10	0.34	3.22	2.68	73.56
							18"-21"	6.01	0.10	0.45	4.38	1.92	74.06
							21"-24"	6.14	0.11	0.42	3.62	1.85	74.58
MANURED.													
0-3"	5.52	0.097	0.73	7.5	2.24	72.06	0"-3"	6.49	0.14	1.07	7.90	2.45	71.62
3"-9"	7.69	0.089	0.77	8.5	2.31	69.40	3"-9"	7.22	0.11	0.74	6.92	2.61	72.22
9"-15"	7.92	0.067	0.38	5.6	2.13	67.22	9"-15"	7.70	0.079	0.69	8.91	2.31	72.24
15"-21"	6.20	0.069	0.33	4.8	1.94	70.56	15"-24"	7.31	0.070	0.59	8.41	2.07	71.30
21"-24"	7.42	0.071	0.53	7.5	1.60	80.02							

The investigation of those soils is being continued by the changes in soil texture, degree of fertility nutrient content and efficiency of clay complex due to the treatments as well as the residual effect of the crops grown seem to be clearly reflected and localised in the soil profile. The superficial root system of Cambodia cotton seems to be acting in the same manner as heated soil treatment.

(iii) *Soil moistures and crop growth*—In 1932 observations were taken to estimate the capacity for moisture retention of three typical fields at the Institute Field 31 (black soil two to three feet deep), Field 22 (dark grey, two to three feet deep liable to surface wash) and Field 40 (well-drained, light grey and seven to fifteen feet deep). Samples of soil were taken on the 29th August from 0.3 inches depth and a month later from 9.12 inches in addition after rainless periods of two and three weeks respectively. Results are given below —

TABLE 27

## A

*Mean percentage moisture (on fresh basis)*

Depths of sampling	29-8-32			29-9-32		
	Field 22	Field 31	Field 40	Field 22	Field 31	Field 40
0" - 3"	20.15	28.85	25.10	22.95	25.18	22.72
9" - 12"				22.02	22.67	20.07

Significances

P

Sig. diff.

	Fields	<0.01	—
	Dates	<0.01	—
	Depths	<0.01	—
B	Fields × dates	<0.01	1.90
C	Fields × depths	<0.01	1.90

## B

Dates of sampling	Field 22	Field 31	Field 40	Mean for dates
29-8-32	29.15	28.85	25.10	27.6
29-9-32	22.95	25.18	22.72	23.62
Mean for fields	26.05	27.02	23.89	

## C

Depths of sampling	Field 22	Field 31	Field 40	Mean for depths
0" - 3"	22.95	25.18	22.72	23.62
9" - 12"	22.02	22.67	20.07	21.68

On the first date, the surface moistures in Fields 22 and 31 were equal and greater than those in Field 40. A month later, in the first two fields, they were greater than the moistures in lower depths, but not so in Field 40. The moistures in both depths in Field 31 were much higher than those of the corresponding depths in Field 40, but they were higher than those in Field 22 only for the upper layer.

The black soil maintained a higher moisture level, especially at the surface, than the light-grey deep soil while the surface-washed soil showed extreme fluctuation. Previous experience indicated that cotton yields were fairly high in Field 31, fluctuated very much in Field 22 and were low in Field 40.

In 1934, the moisture distribution was studied in other fields during wet spells, Nos. 8 and 20, liable to surface-wash and No. 6, well-drained and fertile, were selected. Observations for soil moisture were taken on 13th August from 0-3 in., and below in three inch zones to 24 in., on patches carrying poor growths and the adjacent areas around them with better growths of cotton and other crops in each field. They were confirmed for the upper zones from data taken a month later. The results are given below :—

TABLE 28.

## A.

*Mean percentage moisture (on fresh basis) 1934.*

Depths of sampling.	Good area.			Bad area.		
	Field 8.	Field 20.	Field 6.	Field 8.	Field 20.	Field 6.
0"-3" .. ..	31.1	25.3	23.8	32.6	30.1	28.0
6"-9" .. ..	26.0	22.7	23.8	27.3	25.7	25.0

Significances :—

P.

B. Fields .. ..	<0.01
C. Good v. Bad area .. ..	<0.01
D. Depths of sampling.. ..	<0.01

## B.

Field 8.	Field 20.	Field 6.	Significant difference.
29.2	25.9	25.1	2.5

## C.

Good area.	Bad area.	Significant difference.
28.1	25.4	2.04

## D

0-3 inches	6-9 inches	Significant difference
28.5	25.1	2.04

## E

Area	Depths in inches				Mean for good v bad areas
	0-3	6-9	12-15	21-24	
Good	26.9	24.4	22.2	22.0	24.1
Bad	31.7	26.5	25.7	24.1	27.0
Mean for depths	29.3	25.5	23.9	23.5	

Significances —

P

Sig difference

Good v Bad area

&lt;0.01

1.95

Depths of sampling

&lt;0.01

2.20

Field 8 was in general moister than the others. The moisture was highest in the first 3 inches layer, next came 6.9 inches and below one foot it remained at a constant level. Poor areas more moister at each depth in all the fields.

In all the soils examined precipitation does not seem to move quickly enough to the permanent moist zones below. Hence there always exists in the rainy season a downward gradient of diminishing moisture during wet spells and in dry intervals even when a thin surface layer of air-dry soil is formed. Thus the surface does not permit all the water to percolate; the excess flows over causing severe surface-wash. The wet weather accumulations and the dry weather losses in the upper foot of the soil vary inversely with its fertility.

Observations on crop growths in the same patches were taken from time to time; the cotton crops were destroyed in both years by excessive rains. The following tables (29 and 30 A-D) include the observations on jowar for 1934 and on wheat for 1933.

TABLE 29

*Jowar crop—good and bad areas 1934*

—	Good area	Bad area	P	Sig diff	Between	r
Grain in gms per plant	34.0	12.4	<0.05	19.49	Grain and Heights	.999
Heights in inches	76.2	53.1	<0.05	15.63	Grain and Kadbi	.999
Kadbi in gms per plant	72.3	20.2	<0.05	39.2	Heights and Kadbi	.999



TABLE 30.

A.

*Mean yield in gms. per plant : Wheat—1933.*

Description.	Grain.		Bhusa.	
	Early matured.	Late matured.	Early matured.	Late matured.
Field 30.				
Patch 1 .. ..	27.5	19.6	32.4	25.7
Patch 2 .. ..	20.8	12.8	25.9	16.4
Field 16.				
Patch 1 .. ..	22.4	23.6	34.3	36.0
Field 18.				
Patch 1 .. ..	62.4	14.1	92.0	18.5
Patch 2 .. ..	34.0	16.0	54.5	27.5
Border .. ..	20.5	42.6	24.1	51.7

Significances :—	P.		Sig. difference.	
	Grain.	Bhusa.	Grain.	Bhusa.
Early vs. Late maturity .. ..	<0.05	<0.01	—	—
Fields .. ..	<0.05	<0.01	—	—
Patches .. ..	<0.05	—	—	—
B. (Early vs. Late) × Fields ..	<0.01	<0.01	1.42	—
C. (Early vs. Late) × Border vs. Patches .. ..	<0.01	<0.01	1.27	1.67
D. (Early vs. Late) × Fields × Patches .. ..	—	<0.05	—	3.05

B.

Type of maturity.	GRAIN.				BHUSA.			
	Field 30.	Field 16.	Field 18.	Mean for early and late.	Field 30.	Field 16.	Field 18.	Mean for early and late.
Early... ..	3.02	2.80	6.03	3.91	3.64	4.29	9.16	5.49
Late .. ..	2.03	2.95	1.89	2.68	2.63	4.50	2.89	3.66
Mean for Fields.	2.52	2.88	3.95	..	3.14	4.39	6.01	..

## C

Type of maturity	GRAIN		BHUSA	
	Border	Patches	Border	Patches
Early	2 56	4 18	3 01	5 98
Late	5 33	2 15	6 46	3 13
Mean for border and patch	3 04	3 16	4 73	4 55

## D

Type of maturity	BHUSA			
	Field 30		Field 18	
	Patch 1	Patch 2	Patch 1	Patch 2
Early	4 05	3 24	11 50	6 81
Late	3 21	2 05	2 31	3 44

The grain heights and Kadbi of jowar plants were greater in the good areas than in the bad. In all fields portions of wheat crop were always observed to show delayed maturity in plants growing on patches inside the field which remained moister in the monsoon and also for those along the borders which were not so moist. It was found in 1933 that these late maturing plants inside the field yielded less than early plants around them but the late plants along the border yielded better than their neighbours and as well as the early plants inside the field. The early border plants yielded more grain and as much Bhusa as the late plants of the inside patches. It is thus evident that moist patches depress the yields of the succeeding *rabi* wheat and also delay its maturity.

Comparing the two groups of late plants the lateness of the moist patch plants seems to be due to their weakened vigour that of the border plants is not due to weakening but presumably to their ability to tap more water in the absence of competition and in spite of their prosperous appearance their yield is only equal to that of the early plants inside the field.

It appears that vigour and health of crops are determined by the soil capacity for free water movement in wet weather in the first foot and moisture retention in dry weather. This is why texture improvement by humus supply shows superiority over other methods.

(iv) *Regional soil profiles—some comparisons*—The ability of Badnawar (Dhar) and Jaipur soils to grow healthy crops of Cambodia cotton and the higher nitrifying activity in Jaipur soils compared with those of Indore suggested a detailed study of typical profile (five feet deep) from each region.

The usual mechanical and chemical analyses were made and hygroscopic moistures, maximum moisture—holding capacity and available potash and phosphates were deter-

mined, the latter in inorganic and organic forms. Some of the outstanding differences are noted below :—

TABLE 31.

*Differences in profile characters.*

## A. MECHANICAL.

Percentage of.	Jaipur profile.		Badnawar profile.		Indore profile.	
	1st zone 0-6".	2nd zone 6"-15".	1st zone 0-12".	2nd zone 12"-24".	Field 31.	
					1st zone 0-12".	2nd zone 12"-24".
Coarse sand ..	2.73	1.92	0.80	0.68	0.24	0.87
Clay .. ..	6.15	7.35	16.35	29.90	41.60	35.95
Co <sub>2</sub> .. ..	0.02	0.02	2.53	1.58	0.44	1.45

## B. CHEMICAL.

*Available in the first zone.*

Soils.	Per cent. Total N.	Per cent. available P <sub>2</sub> O <sub>5</sub>	Per cent. available P <sub>2</sub> O <sub>5</sub> on total.	Per cent. on available P <sub>2</sub> O <sub>5</sub>		Ratio, org. to Inorganic P <sub>2</sub> O <sub>5</sub>
				Inorganic P <sub>2</sub> O <sub>5</sub>	Organic P <sub>2</sub> O <sub>5</sub>	
Jaipur .. ..	0.013	0.0075	19.95	16.00	84.00	5.25
Badnawar ..	0.041	0.0407	28.87	21.87	78.13	3.58
Indore F. 31 ..	0.036	0.0332	47.69	23.74	76.26	3.21

## C.

*Available potash in the first zone.*

Soils.				Per cent. available K <sub>2</sub> O	Per cent. available K <sub>2</sub> O on total K <sub>2</sub> O
Jaipur .. ..	..	..	..	0.0248	22.15
Badnawar ..	..	..	..	0.0419	7.26
Indore .. ..	..	..	..	0.0287	5.51

## Ratios of available nutrients in the first zone

Soils	N to av P <sub>2</sub> O <sub>5</sub>	N to av K <sub>2</sub> O	av P <sub>2</sub> O <sub>5</sub> to av K <sub>2</sub> O	Available		N to In org av P <sub>2</sub> O <sub>5</sub>	N to org P <sub>2</sub> O <sub>5</sub>
				Inorg P <sub>2</sub> O <sub>5</sub> to K <sub>2</sub> O	Org P <sub>2</sub> O <sub>5</sub> to K <sub>2</sub> O		
Jaipur	1 73	0 52	0 30	0 05	0 25	11 06	2 06
Badnawar	1 01	0 96	0 97	0 21	0 76	4 61	1 29
Indore	1 08	1 25	1 16	0 28	0 88	4 56	1 42

The proportion of coarser fraction was greater and that of clay less in the top zone than below in Jaipur and Badnawar soils and *vice versa* in Indore soils

Carbonates gradually increased with depth in Jaipur. In Badnawar soil the percentage was high in the top zone and low in the Indore soil. In each it then alternated in successive lower layers.

The percentage of available phosphates on total was least in the Jaipur surface zone and greatest in that of Indore. Always more than 75 per cent of the available phosphate was in the organic form and this was highest in the surface horizon of the Jaipur profile and lowest in Indore, both its absolute percentage and its ratio to the inorganic form were highest in Jaipur and lowest in Indore soils.

Similarly the available proportion of total potash was highest in Jaipur and lowest in Indore soils.

In Jaipur and Badnawar soils much more potash was available in proportion to nitrogen than in Indore soils. In the same way in proportion to phosphates both organic and inorganic the largest amount of potash was available in Jaipur soils and least in Indore soils.

These differences seem to be interesting in the light of the results discussed in the cotton wilt section of this report (9) (a) and those on nutrition (9) (b) (c) and (d).

## 10 CROPS OTHER THAN COTTON

(a) *Plant Breeding* — Study of the crops of Central India and Rajputana immediately reveals the great importance of local adaptation. This is shown in the frequent failure of varieties in trials carried out outside their native tracts and by the failure of types brought into the Institute's plant breeding plots from outside districts even though these may apparently belong to the same tract. It follows that if the Institute's plant breeding work is to be of value to the whole of the area served it must be carried out in such a way that advantage is taken of the selective action of local environments. Methods of selection are therefore being studied with a view to devising a technique simple enough and rapid enough to be carried out by busy local officers with the assistance of one or two advisory visits per annum from members of the Institute's staff. This work has been started both at the Institute and at outstations on Jowar (Sorghum) Bajra (Millet) Tur (pigeon pea) Tilhi (Sesamum) Niger Groundnut Wheat Barley Linseed and Gram. The past years' results with the *khari* crops have already been analysed and are very encouraging.

(b) *Botanical* — The developmental study of bread and durum wheats was carried out in the *rabi* season and the data await analysis. It is not expected that any further experimental work will be required.

(c) *Cytological*.—The development of more profitable lines of work has made necessary the postponement of work on the chromosome number of gram. Chromosome numbers of Indian and Moroccan linseeds were determined in root tip material and were found to be the same in both types.

(d) *Fodder Plants*.—A list of the natural fodder plants occurring in the neighbourhood of the Institute has been compiled, and is available for the assistance of those engaged in agronomic work on fodder improvement.

(e) *Tobacco*.—It is now definite that all types of tobacco, including cigarette types can be grown satisfactorily on any soil in Malwa and in Rajputana and Bundelkhand. The possibility of curing yellow leaf under grass is finally established, and leaf of good quality can be thus produced. Local methods of curing *desi* tobacco have been improved to ensure greater uniformity and quality. A large-scale experiment to find out the economics of the culture of flue-cured tobacco has been undertaken this year in co-operation with the Dhar Durbar, whose enterprise in this matter is much to be commended. The production and grading of the seed have been systematized. The raising of seedlings and cultivation have been improved and made simple. It has been found possible by ratooning to make up for the loss of the crop by frost wherever one or two irrigations can be given. It is also considered that tobacco cultivation can be made more profitable by systematic ratooning of a normal crop.

(f) *Rice*.—Large-scale trials in several parts of Malwa have been undertaken as a preliminary to final recommendation for distribution. It has been found possible to grow a profitable crop of wheat or tobacco following, in the same year, rice grown by the Indore method in which no irrigation or puddling is given. It is remarkably responsible to manures and very high yields have again been obtained of five varieties.

(g) *Sugar-beet*.—Closer spacing increases yields. The crop responds well to artificial manures. The ease and practicability of drying a crop on a large scale has now been proved. The hand-slicer designed at Indore has proved very satisfactory.

(h) *Sugarcane*.—Co. 290 is decidedly the best variety of those so far tried, for all districts in Central India and Rajputana. The Sorghum crosses and some other early varieties imported from Coimbatore have matured in seven months. It seems possible to extend the season for harvesting sugarcane by growing a judicious selection of early varieties to supplement Co. 290. The cultivation of sugarcane has been further improved and made simple and cheaper. Replicated experiments on manuring and irrigations, ratooning and associated growth of varieties are being carried out.

(j) *Lucerne*.—It has been found possible to reduce the cost of seed and irrigation by drill-sowing and implement culture. Good viable seed has now been produced locally.

(k) *Preliminary small growth tests on various crops*.—Kudzu vine, *kolingi*, tepary beans and jute can be easily grown. Guinea grass, *khavi* grass, Wimmera Rye grass and Teff grass seem to stand even the hot weather drought just like other local grasses and appear again with the next rains. Soya beans are now being tested for large-scale cultivation in Malwa and Bundelkhand—they seem to suit the latter area peculiarly well.

## 11. STATISTICS AND FIELD-TRIAL TECHNIQUE.

Four papers on the technique of field-trials, chiefly with reference to cotton, have been written and submitted for publication. Studies of sampling technique for the estimation of yield and of morphological characters are in progress. The work of testing named varieties of the chief crops of Central India and Rajputana is almost finished, and a report of the results obtained and the recommendations made is in preparation. The problem of simplifying field-trials to improve their suitability for out-stations where detailed scientific control is not possible is receiving attention.

In the season under review the randomised block technique was successfully applied to the problem of testing progeny rows in plant breeding work. Problems arising out

of the necessity of using very small plots, the very different amounts of seed available in different progenies and the effect of dispensing with plot margins are being studied and the first results will be ready for publication shortly

## 12 MISCELLANEOUS

(a) *Agronomic survey*—A great deal of information has been collected about the present status of farm crops in relation to their environment and the local economy in Central India and Rajputana. Revenue Department records—a mine of information not yet much exploited in agricultural science—have been freely drawn upon, thanks to the willing co-operation of the State officers concerned

(b) *Soil erosion*—Experience has shown that the system on which the Institute Farm was laid out—rectangular fields graded to a uniform gentle slope of limited length and served with border drains—does not prevent serious erosion in the rains. The method of contour bunding, utilizing suitable perennial plants in strips to arrest water borne silt is being tried extensively to adapt it to local conditions. A number of plants have been tested for this purpose

(c) *Eradication of kans and other weeds*—It was noticed in the making of rain watered compost that all vegetation under the heaps of decomposing wastes was killed after being covered for a month or less. Small scale field trials with covers of green grass or sann hemp showed the same effect and an attempt is now being made to join the function of weed killing to that of green manurings, if successful this promises to be the cheapest means of weed control, costing far less than mechanical and chemical methods used

(d) *Dry farming and humus supply in arid regions*—Following up the results of qualitative tests on the Jaipur State Farm replicated experiments are now laid down to find the best way of retaining the deficient rainfall so as to make possible cotton and other such crops by ensuring the necessary water balance in the crop up to maturity

(e) *The use of heated soil*—The efficacy of heated soil is being tested to enable satisfactory growth of exotic and *desi* cotton varieties which are at present difficult to grow in local black soils. A replicated experiment is also being carried out to compare the efficacy on American and *desi* cottons of heated soil with ammonium sulphate when supplied in combination with phosphatic compost

A simple technique has been devised to make heated soil cheaply in the field with the help of available crop residues

(f) *Poisoned bait for white ants, etc*—The composition of the baits has been improved to make them more attractive and efficacious. Field trials are in progress to determine utility and cost

## 13 COMPOST MANUFACTURE

(a) *Farm refuse*—The rain watered process of compost making has been applied to the utilization of cane trash and an account published which is being reprinted as Institute Bulletin No. 3. Work has been started to devise a technique for composting cane trash during the dry weather and also for utilization of molasses. Another modification recently devised enables residues rich in material of the softer type to be composted without the use of cattle dung and composting is being introduced with entire success in Military stables in the Holkar State

The method of charring and crushing bones for use as manure either alone or in the form of compost has been systematized

(b) *Habitation wastes*—It has been found possible to reduce by about 50 per cent the breeding of fly larvæ on the surface and sides of decomposing heaps even in wet weather by spraying 1 per cent copper sulphate solution after charring and after the first turn. About 2½ lb of copper sulphate per foot length of the charge are required. This reduction is only obtained if the technique for charring and first turn is carefully followed. The

addition of such material does not seem to affect the quality of the compost. The extra expenditure and manipulation involved appear to be of doubtful utility in practice because in any case such larvae are destroyed after the first turn if the process is properly carried out.

Widespread interest has been displayed in the process by Public Health Officers, Municipalities and others both in India and abroad, enquiries are constantly being received, over 500 copies of the Bulletin (No. 1) describing it have been sold and the first edition of 1,500 copies is now exhausted.

(c) *Use of compost*.—A method has been devised and is being tried on a field scale to raise the fertility of *barani* (*mal*) lands more nearly to the level of that of garden lands (*adhan*) by applying manure or compost uniformly in the deeper layers in addition to surface dressings.

#### 14. PUBLICATIONS.

The following papers have been published or submitted for publication :

"The health and vigour of the cotton plant in relation to its environment"—Report 2nd Conf. on Cotton Growing Problems, July 1934; Empire Cotton Growing Corporation.

"Silage making in Mud-walled Towers"—G. C. Tambe and Y. D. Wad; Empire Cotton Growing Review, XI, 1934, No. 4.

"Humus manufacture from cane trash"—G. C. Tambe and Yeshwant D. Wad; International Sugar Journal, XXXVII, 1935, pp. 260-263.

"Some observations on the Inheritance of Form and Size in Asiatic Cottons", by J. B. Hutchinson (To be read at the VIth International Botanical Congress, Amsterdam, September 1935).

"The Classification of *Gossypium* with special reference to the cottons of the Old World," by J. B. Hutchinson and R. L. M. Ghose.

"Studies in the Technique of Field Experiments," by J. B. Hutchinson and V. G. Panse.

(I) "Size, shape and arrangement of Plots in Cotton Trials."

(II) "Sampling for Staple Length Determination in Cotton Trials, with a Note on the Standard Error of Estimates of Ginning Percentage."

(III) "An Application of the Method of Co-variance to Selection for Disease Resistance in Cotton."

(IV) "A Study of Margin Effect in Variety Trials with Cotton and Wheat."

"A Note on the Inheritance of Sterility in Cotton" by J. B. Hutchinson and P. D. Gadkari.

"Nitrogen Balance in Black Cotton Soils in the Malwa Plateau II" by Y. D. Wad and R. K. Aurangabadkar.

Institute leaflets issued or revised during the year :—

No. 5.—"Improved method of gur manufacture" (English and Hindi, illustrated).

No. 7.—"Lucerne Cultivation" (English and Hindi).

No. 9.—"Cultivation of cotton in Gang Canal Colony" (Urdu).

No. 10.—"The Preparation of Bone-char Manure" (Eng.).

No. 2.—"The making of Rain-watered Compost Manure from Farm Wastes" (English and Hindi). Revised June 1935, with one illustration.

The following papers were read at the 1935 Session of the Indian Science Congress Calcutta —

Influences dominating cotton yields in Monsoon Areas—I by Kubersingh and Y D Wad

Nitrogen Balance in Black Cotton Soils in the Malwa Plateau—III, by Y D Wad and R K Aurangabadkar

Provision of Succulent Fodder for Work-cattle in Central India by G C Tambe Chironjilal Nagar and T Krishnamoorthy

Agronomic Adjustments of the cotton crop in Gang Canal Colony Bikaner State by Shamsher Singh and Y D Wad

## THE WORKING OF THE FARM

### 15 EXPERIMENTAL WORK

(a) *Nature of the season* —As usual the monsoon broke in the last week of June and the sowing started on the 26th. On the 27th and the 29th there was a heavy downpour. The fall up to the end of July was 18.9 inches—more than half the average for Indore. The next month was equally wet throughout the total having gone up to 40.07 inches. In September 16 inches of rain fell with a couple of breaks. In October there was no rain. November 5th recorded a fall of 1.34 inches. In January a cold wave lasted for four days. The temperatures recorded were as follows —

1935 January	12	50° F
	13	40° F
	14	34° F
	15	29° F
	16	29.5° F
	17	31.5° F
	18	31.5° F
	19	37.5° F

(b) *Field Trials* —The following experiments were conducted on the Farm —

*Humus supply* —(1) Incorporation of organic matter in the soil (2) Effect on wheat of green manuring with sann at different stages (3) Improvement of water logged soils for *rabi* crops

*Soil improvement* —(1) Improvement by the application of lightly heated soil (2) Control of soil erosion by contour line sowing and the use of arrester crops

*Soil texture and Crop growth* —(1) Winter cultivation of crops (1932 1933, 1934, 1935) (2) Estimation of the relative importance of weeding and interculture (1934 1935) (3) Comparison of the efficiency of different implements of interculture (1933 1934 1935)

*Rotation* —(1) Rotation of crops (1932 1933 1934 1935)

*Associated growth of crops* —(1) Association of cotton with soya beans and cowpeas (2) Spacing test on tur and its association with cowpeas

*Weed eradication* —(1) Eradication of kanks by chemical means

*Treatment of seed* —(1) Trial of Agrosan "G" against Jowar smut

*Multiplication of seed* —(1) Soya beans of 32 varieties in *kharif* (2) Soya beans of 6 varieties in *rabi* (3) Paddy varieties 7 (followed by wheat)



Paddy variety.	Date of harvest.	Paddy yield. mds.	Wheat yield. mds.
Shahjanpur 23 .. .. .	2-10-34	12.0	8.68
" .. .. .	"	15.7	9.85
Shahjanpur 1 .. .. .	"	9.3	9.00
" .. .. .	"	10.6	12.40
Johna .. .. .	"	12.5	10.30
" .. .. .	"	4.3	6.70
" .. .. .	"	20.3	6.70
Datia .. .. .	15-10-34	16.0	4.60
" .. .. .	"	15.4	4.15
" .. .. .	"	11.4	4.27
Bhatta Gurmata .. .. .	29-10-34.	16.3	4.80
" .. .. .	"	14.4	4.50
" .. .. .	"	14.9	4.66
Mushkan .. .. .	8-10-34.	12.6	10.00
" .. .. .	"	17.2	5.40
Pahan .. .. .	10-10-34.	9.0	5.45
" .. .. .	"	4.2	7.60

Paddy not irrigated.

Wheat—2 irrigations.

*Small growths.*—(1) Oats for fodder. (2) Bagilla fodder.

*Sugarcane*.—(1) Multiplication of promising acclimatised Coimbatore varieties and also Sorghum crosses. (2) Varietal trial on S48, Co210, Co213, Co281 and Co290. (3) Agronomy trial on S.48.

*Lucerne*.—(1) Inoculation of seed. (2) Manurial trials. (3) Agronomy trial.

*Sugarbeets*.—(1) Trials in different soils under dry and irrigated conditions.

*Pasture Studies.*—(1) Response of grasses to various manures.

*Compost.*—(1) Preparation of phosphatic compost. (2) Composting cane trash.  
(3) Composting cowdung alone.

### 16. *Crops and Yields.*

[illegible]

			Yields in mds Max	Per acre Min
<i>Irrigated crops —</i>				
Paddy (mushkan)			29 0 mds	12 6 Plot size 50 x 20
Sugarcane	Co210		534 6	
	Co213		464 7	
	Co281		445 0	
	Co290		610 9	
	S 48		318 7	
Lucerne agronomical				
Year	Season	Cuttings	Plot yield in lb	Total per acre in lb
1932-3	Winter	2	5 180	
	Summer	6	27 876	
	Monsoon	3	7 160	45 040
1933-4	Winter	4	10 133	
	Summer	7	10 053	
	Monsoon	2	3 443	26 250
<i>Lucerne manurial</i>				
1932-3	Winter	1	5 307	
	Summer	5	23 613	
	Monsoon	7	4 129	47 070
1933-4	Winter	4	9 189	
	Summer	6	17 858	
	Monsoon	2	4 583	39 470
Peas (green pods) seed		8 8 mds 2 6		

The calculated gross returns from the Farm amount to Rs 5 000. The wet weather coupled with the cold wave reduced this figure seriously.

17 *General* — (a) *In the Stock* — There are 15 pairs of bullocks in all including 6 purchased to replace those that through old age became unserviceable or died. The new pairs are of average size usually found with cultivators.

460 cartloads of compost were prepared from the available farm wastes and 32 cart loads of night soil compost from the residential block (population about 100).

1 145 mds of silage from grass and legumes were made. This provided an excellent succulent fodder for the hot weather.

(b) *Workshop* — This section continued to render useful service in the same directions as reported last year. The sugarbeet slicer devised in the previous year was further improved upon.

A portion of the fence line was repaired and the wood work of the buildings repainted.

(c) *Irrigation* — A persian wheel was installed in place of the Boulton Elevator worked by engine power for purposes of demonstration and economy.

One of the wells capable of commanding a fair area had been out of use on account of its dilapidated condition. The debris was removed and the well cleaned and repaired. Now there is one good well and two of moderate capacity in the 'C' block of the farm.

(d) *Trading Section*.—This section was very busy and considerably more sales than those of the last year were effected in implements, tools and seeds. The demand for the improved seed exceeded the supply.

(e) *Training of students and help to cultivators*.—In all about 120 students from the following States were given training in either practical agriculture or composting farm and habitation wastes :—

Alwar.	Rewa.	Hyderabad (Dn.)	Bundi.	Tonk.
Chhatarpur.	Udaipur.	Jodhpur.	Indore.	
Jaora.	Bharatpur.	Rutlam.	Nowgong.	

According to the status, the students can be classed as under :—

Normal School Boys	..	..	..	..	75
" " Teachers	..	..	..	..	3
State officials connected with agriculture	..	..	..	..	12
Municipal officials and menials	..	..	..	..	10
Army officers Holkar State	..	..	..	..	6
Union Theological Seminary students for rural propaganda	..	..	..	..	15

Trained ploughmen were deputed to various States to teach compost making and *gur* making by the improved method. Many cultivators came directly for information and help showing their confidence in the work.

#### PROPAGANDA AND EXTENSION WORK IN STATES.

18. *Visits to States*.—During the year under report, the Agricultural Adviser made sixteen visits to States, the Extension Officer nineteen, the Geneticist and Botanist seven, the Chemist and Agronomist eleven, and other officers thirteen.

19. *Instructional and training facilities*.—No fixed lecture courses are provided but practical training is given at the request of the Darbars to members of their Revenue and Agricultural staffs and selected cultivators, the programme of instruction being varied in its items to suit individual cases. No fees are charged and free accommodation is usually provided in the Institute's Visitors' Quarters.

Special lectures and demonstrations were arranged for repeated visits from the Kumars of the Daly College (for sons of the Ruling Princes and their relatives) and from the students of the Canada Mission's Theological Seminary, their Rasalpura Vocational School and the Holkar State's Normal School for training rural teachers. Such contact with those who will later be able to encourage agricultural improvement is a matter of great importance.

With the co-operation of the Indore Residency Area authorities training in the Sanitary disposal of habitation wastes by the Institute's composting process has been given to municipal staff from seven member-States, Hyderabad (Deccan) and Chhatarpur States and Nowgong Cantonment, a fee being charged to non-members. Officers from five units of the Holkar State Army were also trained in the process and in that for composting stable refuse. The Secunderabad Cantonment requisitioned the services of a trained assistant for a month to make certain adjustments in the process desirable under the local conditions and to help in the laying out of new disposal grounds under the system.

Lectures and demonstrations were given by the Extension Officer in district tours in eight States. To large village audiences he explained the advantages of growing good crop varieties, of increasing their manure supply by making rain-watered compost from waste, of making grass, *guar* or *bayra* silage for their cattle, using mud walled towers where pits become water logged, the practical possibility of improving their cattle by castrating "Serub" bulls, the lower cost of making better quality *gur* by the McGlashan furnace and a variety of other improvements within the capacity of ordinary cultivators. The services of ploughmen trained in building the McGlashan furnace and in *gur* making were placed at the disposal of the Darbars and were freely used.

Assistance was also given by the Extension Officer in organising demonstrations at twelve agricultural shows and cattle fairs in eight States. Illustrative exhibits were provided, lectures given and cinematograph films shown on agricultural and rural uplift subjects accompanied by running commentaries.

At a public meeting in Jaipur presided over by Lt.-Col. Sir H. Beauchamp St. John, K.C.I.E., C.B.E., Vice-President, Council of State, the Extension Officer explained the work and objects of the Institute to a large audience of landowners, State officials and cultivators, cinematograph films were also shown.

Acknowledgment is due to the Indian Central Cotton Committee and the Central Publicity Officer, Railway Board, for the free loan of films.

F. K. JACKSON,  
Director.

STAFF AND RESEARCH STUDENTS OF THE INSTITUTE OF PLANT INDUSTRY AS ON  
JUNE 30TH, 1935.

*Administrative and Clerical.—*

Director and Agricultural Adviser to States in Central India and Rajputana .. ..	F. Keith Jackson, N.D.A. (Hons.), Dip. Agri. (Cantab.).
Personal Assistant .. ..	A. N. Srivastava, M.Sc.
Head Clerk and Accountant ..	G. M. Nadkarni.
2nd Clerk .. ..	Mohiuddin Khan.
3rd Clerk .. ..	S. M. Ajmi.
4th Clerk .. ..	S. M. Azim.
5th Clerk .. ..	V. R. Shirsath.
Artist .. ..	S. J. Oncar.
Librarian .. ..	Bashir Husain Khan.

*Botanical.—*

Geneticist and Botanist ..	J. B. Hutchinson, M.A. (Cantab.).
Senior Botanical Assistant ..	R. L. M. Ghose, M.Sc.
Plant Breeding Assistant ..	Kuber Singh, B.Ag.
Botanical Assistant .. ..	Vacant.
Statistical Assistant .. ..	V. G. Panse, B.Sc.
Genetical Assistant .. ..	Bholanath, M.Sc.
Computer .. ..	S. A. Khargonkar.
Fieldman .. ..	E. L. Rajanna.
Research Student .. ..	G. K. Govande, M.Sc.*
" .. ..	M. A. Ansari, M.Sc.*
" .. ..	P. D. Gadkari, M.Sc.*
" .. ..	Maya Prakash Singh, M.Sc.†
" .. ..	B. S. Kochrekar, B.Ag.†

*Chemistry and Agronomy.—*

Chemist and Agronomist ..	Y. D. Wad, M.A., M.Sc., A.I.I.Sc.
Laboratory Assistant .. ..	L. N. Desai, B.Sc.
" .. ..	G. T. Shahane.
" .. (Temporary) .. ..	V. V. Dravid, B.Sc.
" .. ( " ) .. ..	S. J. Ghose.
" .. ( " ) .. ..	G. K. Sant, B.Sc.
" .. ( " ) .. ..	P. M. Kulkarni, B.Sc.
" .. ( " ) .. ..	B. Goswami, B.Sc.
" .. ( " ) .. ..	R. S. Gharpure, B.Sc.
Research Assistant ( " ) ..	I. Madhusadan Rao, M.A.
" .. ( " ) .. ..	Chironjilal Nagar, B.Sc.
" .. ( " ) .. ..	V. N. Bhargave, B.Sc.
Research Student .. ..	R. K. Aurangabadkar, M.Sc.*
" .. ..	S. C. Chakarvarty, M.Sc.*
" .. ..	K. N. Ambegaonkar, M.Sc.*
" .. ..	S. B. Mogre, M.Sc.*

*Propaganda and Extension Work.—*

Extension Officer .. ..	M. L. Saksena, L.Ag.
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\* Institute of Plant Industry Studentship.

† Voluntary research worker.

*Farm Executive —*

Farm Superintendent .. ..	G C. Tambe, B Ag
Assistant Farm Superintendent	S C Talesara, B Ag
Junior Farm Assistant .. ..	G G Phadke, L. Ag (on deputation to Bharatpur State as Agricultural Officer)
" " " " " "	N S Apte, B Ag (Actg)
" " " " " "	K M Simlote, B Ag
Fieldman " " " "	Nihalsingh
" " " " " "	V R Sathe
" " " " " "	G M Nigudkar
Storekeeper " " " "	V S Dravid

## INSTITUTE OF PLANT INDUSTRY, INDORE

*Research Programme for 1935-36*

## A GENETICS AND BOTANY SECTION

## COTTON

(1) *Botanical Survey* —Owing to delay in despatch of the specimens promised by the Botanical Survey of India, the contemplated paper on the classification of Asiatic cotton will probably have to be completed in 1935-36

(2) *Genetics* —Study of inheritance of major factors in Asiatic and Indian American cottons

Study of cases of abnormal inheritance of major factors

Study of the inheritance of quantitative characters

Study of interspecific hybrids with special reference to the bearing of heterosis on plant breeding procedure

Study of the rate of mutation in mutable strains

(3) *Cytology* —Study of sterile types derived from an interspecific hybrid (G arboreum × G herbaceum).

Study of chromosome behaviour in F<sub>1</sub>, F<sub>2</sub> and backcrosses of G africanum × cultivated Asiatic cottons

(4) *Physiology* —Study of cotton hair characteristics

Development of tests for lint quality suitable for the needs of the plant breeder

(5) *Selection and Breeding* —Propagation and distribution of Malvi 9 Study of variance in Malvi 1, Malvi 9, and the cross between them and re selection for further propagation, according to the results obtained

Study of and re selection in progeny rows of 1933 selections

Study of problems of transference of herbaceous quality to Malvi type

Study of Cambodia selections grown at Badnawar

Study of selections in Nimar *desi* made in 1933 and grown in 1934 at Dhamnod

(6) *Variety Trials* —Variety trials will be laid down at the Institute and in the territory of member States as found necessary in the light of results obtained from current trials

(7) *Statistics* —The investigations in progress into statistical problems involved in field testing, strain testing where very small quantities of seed are available, and in the examination of segregating progenies, will be continued

## OTHER CROPS.

Work on other crops will be largely confined to the selection and purification of desirable high yielding strains for the main areas served by the Institute, and fundamental research will usually be restricted to cotton. Exceptions from this rule will occur from time to time when opportunities arise of solving general problems more easily than could be done on cotton, and plant breeding material will, of course, be used to the fullest possible extent to provide data of scientific value.

- (1) *Botanical*.—Comparative developmental study of durum and bread wheats.
- (2) *Genetics*.—Study of inheritance of certain characters in local durum wheats.
- (3) *Selection and Breeding*.—Selection and breeding work will be continued on the following crops :—

*Kharif* :—

Jowar.  
Bajra.  
Tur.  
Tilli.  
Niger.  
Groundnut.

*Rabi* :—

Wheat.  
Barley.  
Gram.  
Linsced.  
Kesari.  
Safflower.

A part at least of the breeding material in these crops will be grown on the farms of member-States.

- (4) *Variety Trials*.—Variety trials on all crops of interest to member-States will be laid down in the light of information gained from the current season's experiments.

(5) *Lathyrism*.—Work on Kesari has been resumed, and in connection with it, the botanical and agricultural problems involved in the growth of the associated weeds responsible for lathyrism will be studied.

## B.—CHEMISTRY AND AGRONOMY SECTION.

Continuation of the present work.

Reviewing of accumulated data and writing up the summarised results.

The main feature of the future programme will be considerable increase in laboratory and cultural work side by side with accurate field observations in addition to extensive field experiments of a complex nature. In many cases, suitable technique is not available and will have to be evolved.

*'Leaf-roll' and 'Red leaf' of American Cottons*.—The material collected will be further examined and the results summarised. Work at the Institute has now shown clearly that these phenomena result from certain changes in soils and seasons which are normal to the locality where leaf-roll and red leaf occur. Control of these causative soil-changes has already been achieved in practice at the Institute and the further work intended will be aimed at making control still more widely practicable.

*Bio-chemical studies on 'wilt'*.—The information so far collected will be summarised and further studies will be started to elucidate changes both in the plant and soil which seem to favour the incidence and progress of the disease.

*Factors governing the yield of cotton*.—The data will be summarised for publication and in the light of the results further experiments will be arranged to estimate the relative value of possible modifications in field practice. The influence of the water-supply upon the spinning and other qualities of cotton will be further investigated following the clues obtained from Ganganagar results.

*Crop vigour and seed composition*—This work is to be continued. Studies similar to those on groundnut will be made on linseed and wheat for comparison with those on cotton. The work projected in the 1934-35 programme on *Reaction changes in sap* and on *Ripening of cotton bolls* has been suspended, in favour of soil fertility studies which seem likely to give profitable results earlier.

*Other factors*—The preliminary results will be reviewed for publication and further work planned mainly with a view to get an estimate under controlled conditions of the disturbances in vigour and health of *desi* and American cottons commonly observed in the field. A study will also be made, if possible, of the likely share, in determining the health and vigour of the cotton plant, of disturbances in the respiration of roots which appear to take place in the field.

A beginning will be made to study the relative influence of the course of nutrition and its balance during the early stages of cotton growth, on its period of maturity as well as cropping vigour and quality, following the clues secured from the tests made during this year both with cotton and other indicator-crops. Sugar beet and Pyrethrum have been found very useful as they give rapid indications. These studies will include both potcultures and field experiments.

*Nitrogen-balance in the field*—Further aspects of this problem will be taken in hand.

*General soil studies*—Results will be summed up for publication.

(1) Three more soil types in their important phases will be taken up. The soils in hand will be examined further.

(2) Soil samples from field experiments will be examined.

(3) Water regime of the black soils of Malwa during rains and the arid soils of Bikaner throughout the year will be studied in a preliminary way.

(4) The movement and changes in the solubles will be similarly studied at both places with special stress on important environmental phases usually prevailing in the local cotton fields during the season.

(5) The study of the alterations by surface treatment of the soil profile as well as the influence of the growing crop upon it will be pushed further.

(6) The changes and fluctuations in soil properties at different periods of the crop season will be estimated item by item.

(7) A measure of the seasonal changes in the physical conditions of natural soils will be taken with reference to the causative factors and resulting effect on the exchange status, availability of phosphates and changes in organic matter.

*Soil studies in relation to plant growth*—(1) Attention will be concentrated on estimating the influence, on the final yield of the local cotton crop, of the several checks during wet spells and the extent to which they may be affected by soil conditions.

(2) The work already in hand upon plant growth in rich and poor patches in the same field is to be continued with a few alterations.

*Rotation*—It is intended to make a more comprehensive attack on the fundamentals of this problem and hence in addition to the present work attempts will be made to assess the positive or negative residual effect of individual crops on the soil and also to develop a profitable and convenient system for the simultaneous growth of two or more crops.

*Water logged soils and erosion*—A few fields will be put under the control methods found promising in order to estimate the rate and extent of probable improvement in fertility.



*Eradication of weeds.*—Trials will be made of several promising methods on a rather larger scale.

*Control of white ants.*—A method will be sought to make the bran bait harmless to men and livestock.

*Opium crop substitutes.*—After the review of the information collected definite systems will be recommended and additional improvements at present in contemplation will be pushed further.

*Supply of fodder.*—A start will be made to test the influence of erosion control on grasslands. Some of the promising grasses will be tested for their hardiness and their capacity to compete with established varieties. Fresh varieties will be imported for preliminary trials.

*Further improvements in compost-making.*—Composting of cane trash with artificial watering in dry seasons will be adjusted for large scale operations with particular emphasis on the utilisation of molasses.

Preliminary trials will be made to develop properly-balanced, as well as quick-acting, composts with a view to utilise them for reducing the degree of soil deterioration during the period of crop growth. A good deal of theoretical work will have to be done in the beginning.

*Root-studies.*—Further adjustment in the technique for different purposes will be made. An interpretation of the large number of drawings collected will be continued.

*Soil microbiology.*—The influence on the biological population of soils, of the conditions hitherto found prominently affecting the health and vigour of crops will be studied.

*Note.*—It will be noted that in the above programme attention is either restricted to gaining a general idea or concentrated upon details of a particular aspect, depending upon the present stage reached.

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## APPENDIX V.

## PROGRESS IN THE INTRODUCTION OF IMPROVED VARIETIES OF COTTON

**BOMBAY**—(1) *Broach tract*—The Indian Central Cotton Committee, at their meeting of January, 1934, finally decided in favour of the policy of growing 1027 A L F throughout the tract south of the River Narmada and also sanctioned a five-year scheme costing Rs 65,000 for the multiplication and distribution of 1027 A L F seed in this tract. In pursuance of that policy, vigorous propaganda was carried out among cultivators to give up inferior cottons. These measures resulted in an increased demand for 1027 A L F seed and the Sonsek Co-operative Cotton Sale Society and other Societies took to the growing of 1027 A L F cotton.

During the year under report an area of 23,751 acres was maintained for seed multiplication purpose. Out of the 1,884,084 lb of seed purchased last season, 1,506,255 lb were supplied to British residents from 28 seed depots in the Surat tract and the remaining 377,830 lb were supplied to Chhota Udepur and Baroda States. Besides, 428,734 lb of seed were supplied direct by the Hansot Society Seed Group. The total seed distributed therefore amounted to 2,312,818 lb. This was a record figure in spite of the fact that Rajpipla State did not, as usual, purchase 1027 A L F seed from the Department and managed to meet their seed requirements from their own crop.

(2) *Khandesh tract*—During the year *Banilla* cotton was grown in Khandesh on an area of about 130,000 acres representing about 12 per cent. of the total area under the cotton crop. The total production of *Banilla* cotton is estimated at 30,000 bales with an average of about 92 lb of lint per acre. As a result of the Seed Expansion Scheme financed by the Indian Central Cotton Committee, Bombay, *Banilla* cotton has spread to a larger extent in the talukas of Amalner, Shirpur, Erandol, Pachora and Chalisgaon than in other talukas. The quality of cotton was generally satisfactory and pure *Banilla* cotton fetched a premium of Rs 5 to Rs 10 per *khandy* over the local cotton according to quality. The seed extension scheme financed by the Indian Central Cotton Committee, Bombay, reached its fourth year during 1934-35. An area of 15,983 acres was organised for the multiplication of pure pedigree seed and from this area, 1,900,000 lb of seed was obtained.

(3) *The Deccan Canal's tract*—The total area under cotton on the Deccan Canals tract was 17,000 acres during the season and of this 5,000 acres were under *Banilla*. The Department is carrying on vigorous propaganda to introduce *Banilla* cotton in this tract as it yields better than the local N R mixture and fetches Rs 5 to Rs 10 more per *khandy* of 600 lb of *Rapas* than local cotton. A five year scheme costing Rs 23,800 is being financed by the Indian Central Cotton Committee for the extension of this variety in the tract.

(4) *The Kumbha Dharwar tract*—The work of introducing two improved varieties of cotton, viz., *Jayawant* and *Gadag No. 1* was carried on an extensive scale through the Hubli and Gadag Cotton Sale Societies, with the aid of funds provided by the Indian Central Cotton Committee. The reserved area maintained for multiplying pure pedigree seed of *Jayawant* cotton at the Hubli centre was 21,000 acres and that of *Gadag 1* at the Gadag centre was 25,012 acres. The quantity of seed received by the Societies from these reserved areas was 1,602,832 lb of *Jayawant* and 1,250,000 lb of *Gadag-1* sufficient to cover 161,000 and 125,000 acres respectively, during the coming season.

For distribution of general pedigree seed stocked by the Co-operative Cotton Sale Societies, seed-depots were opened as usual in different selected centres. The general area grown with pure seed was 126,286 acres under *Jayawant* cotton as against 105,708 acres of last year, and 65,238 acres under *Gadag 1* cotton as against 44,800 acres of last year. The estimated yield of *Jayawant* was 15,000 bales as against 17,500 bales of last year, and 4,600 bales of *Gadag No. 1* as against 5,600 bales of the previous year.

Besides, the Hubli Sale Society sent outside its area of operation 450,540 lb of *Jayawant* seed enough for 45,050 acres. The total area under pure seed of *Jayawant* cotton was,

for spinning 50 s. These improved strains have been tested on field scale and are found to grow well in Sind specially in East Sind. They are, however, peculiarly susceptible to white ant attack specially on virgin soils. The average yield was about 10 *maunds kapas* per acre in comparison with about 12 *maunds* obtained with Sind American on good lands. The staple of these fine quality cottons is fine and strong. They require better cultivation than Sind American or *deshi* cotton and should be grown on the best portion of the area to be put under cotton. During the year 1934-35 about 150 acres only were grown to these cottons but during the current season 1935-36 the area has increased to 2 400 acres.

*Sind Deshi cotton* — This cotton has a special market of its own on account of its bright colour and rough feel being suitable for mixing with wool. It is very hardy and resists variations of soil, climate and season. It is capable of giving high yields and can be sown late i.e., in the month of June. The improved *Sind deshi* strain 27 W N, evolved by the Agricultural Department gives an early and abundant crop (about 15-20 per cent greater outturn than ordinary *Sind deshi* and a 4-5 per cent higher ginning outturn i.e., 38-39 per cent). This improved strain is now the standard *deshi* cotton in Sind. Trade opinion in Karachi considers that the total *deshi* crop which can be profitably consumed should not exceed 2 00 000 bales per annum. Any increase above this figure is likely to glut the limited market and result in reduced prices to the growers.

THE ECONOMIC SIDE — The economic side of the question which is of primary importance to the grower depends largely upon the prices prevailing for the various types of cotton. During 1934-35 these cottons were sold in large quantities at the following rates —

Variety	Price of cotton lint.	
	Per maund of 82 lb	Per khandy of 784 lb
SIND AMERICAN —	Rs a p	Rs a p.
4F 98	25 0 0	238 4 0
289F 1	27 0 0	257 5 0
SIND EGYPTIAN AND SEA ISLAND —		
<i>Sea Island 2 4</i>	44 7 10	424 0 0
<i>Boss III-16</i>	44 7 10	424 0 0
<i>Ashmoun 37</i>	37 10 8	359 0 0
<i>Sind Deshi 27 W N</i>	15 8 0	147 11 5

The price of Broach cotton was Rs 229 when Sind Egyptian and *Sea Island* cottons were sold at the above rates.

For successful cultivation of long stapled and fine quality cottons it is necessary to evolve a reliable marketing organisation which will secure adequate premium for quality from the trade. The Indian mills have of late shown considerable interest in these long stapled cottons and it is upto them to give an encouragement to the growers of these cottons for their future supply.

*Extension and pure seed multiplication* — The pure seed extension scheme is based on 'Unit' system each unit representing a final area of 25 000 acres under one improved variety. In this scheme which has now reached its fourth stage the programme adopted for multiplication and distribution of pure seed consists of five progressive stages, viz., (1) Seed patch 2½ acres, (2) Increase block 25 acres, (3) Field scale plantings 250 acres,

(4) Village groups 2,500 acres, (5) District groups 25,000 acres. The first three stages are under departmental supervision. The last two stages are being arranged through selected growers and co-operative organisations. Ten such units have been started to supply seed to different cotton growing tracts. Thus 3 units have been fixed for 27 W.N., 1½ unit for improved Sind American 4F-98, 4½ units for improved Sind American, 282F-1 (to be named 'Sind Sudhar' cotton), and one unit under high quality cottons.

The produce of the first three stages of the seed multiplication scheme was ginned under the supervision of the Agricultural Department and about 13,000 *maunds* of seed of improved strains evolved by the Agricultural Department were distributed for sowing in the current year 1935-36.

MADRAS.—I. *The Southern tract*.—(A) *Cambodia—Coimbatore*.—(i) The multiplication of pure Co. 2 cotton seed for distribution to cultivators continued as in previous years. The seed farms were continued by annual contract with co-operative seed societies as in the previous year. During the year, there were thus 854 acres (under annual contract) of seed farms with 3 societies consisting of 105 members at Tiruppur centre as compared to 954 acres with 3 societies of 148 members in the preceding year. This area is under the direct supervision of the Agricultural Department and named as "Inner Area". The selected seed out of this (Inner) area was supplied to the Tiruppur Co-operative Trading Society, Ltd., Tiruppur, for sowing their annual contract area. The Tiruppur Co-operative Trading Society had 5,152 acres with 21 societies in Avanashi and Palladam Taluks as against 4,164 acres with 7 societies in Avanashi Taluk during last year. Due to fodder scarcity the *ryots* were obliged to reduce the area under cotton and increase the area under fodder and grain crops. Hence the Tiruppur Co-operative Trading Society could not run total contemplated area of 6,000 acres of Co. 2 cotton under seed farm during the year. The total seed farm area in 1934-35 was thus 6,006 acres as against 5,118 acres in the previous year.

(ii) Pure Co. 2 seed produced by the Agricultural Department and the Tiruppur Co-operative Trading Society including the natural spread is estimated to have covered 66,000 acres in 1934-35 season. In addition, 69,479 lb. of Co. 2 seed sufficient for about 2,750 acres was supplied to other districts in the Presidency.

(iii) 1,769 *khandies* and 459 lb. of lint were obtained from 1933-34 seed farms and were sold at an average premium of Rs. 10 per *khandy* on the date of sale. The gradual reduction in premium is due to the high quality of lint that is being marketed owing to large distribution of pure Co. 2 seed by the Department during the past few years.

(iv) During the coming season (1935-36) an area of 800 acres of Co. 2 seed farms will be under the control of the Agricultural Department and about 6,000 acres under the control of the Tiruppur Co-operative Trading Society. Due to adverse weather conditions during 1934-35 season, the yield was about 50 per cent. less than normal. There will not therefore be much increase in the area under the improved strain in the coming season.

(v) *Cambodia—Trichinopoly*.—In the Trichinopoly District, 21,700 lb. of Co. 2 Cambodia seed was distributed to the *ryots* by the Agricultural Department as compared to 8,097 lb. distributed in the previous year. This variety covered an area of about 1,450 acres during the year and it is estimated that the area during the coming season would be 2,314 acres in this district.

(vi) *Cambodia—Madura*.—The area under Co. 2 seed farms was 176 acres as against 123 acres in the previous year. The quantity of seed distributed during the year from the seed farm was 68,635 lb. enough to cover an area of 4,575 acres as compared to 42,249 lb. for 2,816 acres in 1933-34. The area under this improved strain is now estimated to be 35,415 acres. Cambodia is a rainfed crop and in the *Masipattam* sowings (March-April) in the single crop paddy area is getting to be more and more popular.

(B) *Karunganni—Coimbatore*.—The multiplication of C. 7 *Karunganni* strain of the Tinnevely tract which has become popular in Coimbatore with a corresponding reduction in the *Uppam* area was continued. The propagation of this strain through seed farms similar to those for Cambodia was continued. During the year under report, there were

745 acres of seed farm at Udamalpet (Annual contract) with 20 *ryots* as compared to 809.87 acres of seed farm with 18 *ryots* in the preceding year. 98,717 lb of *C 7 Karunganni* cotton seed were distributed to the cultivators in the year. It is estimated that this strain will occupy an area of about 15,000 acres. The yield of lint from 1933-34 seed farms was 100 *khandies* 11 lb. The seed farm lint commanded a premium of Rs. 4 2 0 per *khandy* of 500 lb in the market on the date of sale.

**Karunganni—South**—The area under *Karunganni* strains *C 7* and *A 10* seed farms was 1,330 acres as against 1,202 acres of the previous year. Strain *C 7* is popular in the Tinnevely district while *A 10* is in great demand in the Madura and the Western Taluks of the Ramnad district. The quantity of seed distributed from seed farms in 1934-35 was 137,785 lb sufficient for an area of 11,149 acres as compared to 118,800 lb sufficient for 9,900 acres distributed in 1933-34. The area under these strains covered by natural spread is estimated to be 117,748 acres. It is proposed gradually to replace this strain by another promising strain *Koilpatti No 1 (Karunganni)*. Seed of the new strain for growing nearly 500 acres in the coming season has been obtained.

**II Northern and Western tract**—**A Northern**—On account of the very limited area where *N 14* can be grown profitably, no seed farms were maintained and the total quantity of seed sold was 750 lb as compared with 9,933 lb in the previous year. It is estimated that this strain was cultivated on an area of about 2,500 acres only as compared with 3,194 acres in the previous year. It is estimated that on account of an exceptionally good season, an average yield of 350 lb *kapas* per acre was obtained as against about 70 lb per acre in the previous year. The premium paid by Messrs Binny and Co was Rs. 10 to Rs. 15 per *khandy* (500 lb).

**B Western**—The area of seed farms maintained and sown to *H 1* was 3,588 acres as compared with 2,895 acres in the previous year. 291,233 lb of *H 1* seed were distributed in 1934-35 as compared with 223,300 lb in the previous year.

The area sown to *H 1* is estimated to be about 204,000 acres as compared with 200,379 acres in the previous year. The average yield was about 129 lb of *kapas* per acre as compared with 200 lb in the previous year. The low yield was due to the exceptionally unfavourable season. The local mixed cotton gave an average yield of about 75 lb *kapas* per acre as against 150 lb in the previous year.

By means of co-operative marketing, 600 bales of *H 1* lint was sold by *ryots* assisted by this Department and the premium realised ranged from Rs. 3 8 to Rs. 5 per bale of 400 lb. The fall in the premium is due to the poor quality of lint caused by low rainfall.

**Central Provinces and Berar**—The recognition during the year of the two new cottons *V 434* and *Late Verum* as standard Indian cottons marked a further step in advance in the work of cotton improvement in these provinces. The chief feature of the year was the success which attended the cultivation of *V 434*. Grown under a wide range of conditions, this cotton proved to be the best all round type available at present—hardy, prolific and superior in lint. At the Government Experimental Farm, Akola, an average yield of 635 lb per acre was recorded which was 48 per cent higher than the annual average outturn of Farm for the past 25 years. Similar reports were received regarding its behaviour and cropping power from other places where it was tried. It showed remarkable adaptability to variations in climatic conditions which were so marked a feature of the past year, gave good outturn of superior quality lint and thus proved its superiority over all other strains known at present. In spinning capacity it actually showed an improvement over the past season. A representative sample of it sent to the Technological Laboratory, Matunga, Bombay, was very well reported upon and adjudged suitable for spinning 37's standard warp counts—a great advance over the 8's of *Roseum* and 20's of *Verum 262*. During the past two years this cotton has secured an average premium of Rs. 10 over the *Late Verum* or Rs. 20 over *Verum 262*. The area under it in the past season was estimated to be 2,000 acres which should ensure about 20,000 acres in the coming season if all the seed gets sown.

There is no doubt that in future success in cotton growing in these provinces would be in medium staple cottons or types that would spin higher counts than 20's. Realising that the demand for coarse cottons in the near future may become still smaller, the

Agricultural Department in collaboration with the Indian Central Cotton Committee has launched a five years' scheme for increasing the proportion of finer varieties that can compete in the world market.

The total area under *Verum* cottons during the past season was 107,200 acres compared with 89,000 acres in the preceding year.

*United Provinces.*—*C. 520.* This cotton is spreading rapidly and reached 14,431 acres during the year under report.

*A-19* seed sufficient to cover an area of 28,383 acres was distributed during the year from departmental and private agencies.

*C. 402.*—Owing to unfavourable weather conditions in the season 1933-34 the cotton area sown in the Sarda Canal suffered and the produce obtained was very poor. The prices realised, however, for such cotton lint as there was was 30 to 40 over Broach and the Bilgram Cotton Purchase and Sale Society on an investment of about Rs. 17,000 made a profit of Rs. 11,000. A premium of Rs. 1-8-0 per *maund* was paid to the cotton growers selling through the Society. This however scarcely compensated for the very low yield got from this cotton. The area under this cotton in the Sarda Circle in the year under report was 2,746 acres.

*Punjab.*—The total area under American cotton in British Districts was 840,700 acres as compared with 809,120 acres in the preceding year. Of this *4-F* was grown on 769,700 acres and *289-F* was reported to have been grown on 56,000 acres.

2. The total area under *desi* cottons in the province (excluding Indian States) was 1,506,300 acres against 1,640,300 acres in the last year. *Mollisoni*—a selection of the *Indicum* variety—was grown on 727,200 acres whilst a type of improved *Roseum* covered an area of about 52,000 acres.

3. As a result of Research carried out in recent years at Lyallpur under a scheme financed jointly by the Punjab Government and the Indian Central Cotton Committee several new strains of cotton, both *desi* and Punjab-American, have been evolved. Some of these new cottons are destined to take an important place in the cotton crop of the province.

Amongst *desi* cottons the most important selection produced so far is *15 Mollisoni*. This cotton, selected some years ago for its uniformly good yield, is now the chief commercial *desi* cotton of the Canal Colonies.

Amongst the new Punjab-American cottons is the variety known as *43-F*. This variety is a very distinct improvement over *4-F*, the present day commercial variety of Punjab-American cotton, in several respects such as (1) early maturity, (2) resistance to the attack of jassids (Tela), (3) length of staple (average length  $1\frac{1}{2}$  inch. against  $25/32$  inch in the case of *4-F*), (4) high spinning counts (35's for *43-F* and 21's for *4-F*) and (5) high yield.

BURMA.—(1) *Myingyan Circle.*—The total area under improved departmental cotton was 3,769 acres all of which was put down to the re-selected *C/19* strain. The resulting crop gave an average outturn of 38 per cent. while the ordinary Wagale crop gave only 32 per cent. The total quantity of *kapas* of the improved strain ginned at the Mahlaing Central Farm ginnery was 127,305 *viss* (124,186) and 75,368 *viss* (73,338) of *C/19* seed are available for distribution.

At the Mahlaing Central Farm the improved *C/19* white flowered strain was again yield tested against three hybrid strains, *viz.*, *L11* × *W6*, *C/19* × *W5* and (*S* × *W*) × *W3*, one mixture of pure strains, and the original Pwinbyu. Results tended to confirm those of previous years showing *L11* × *W6* to be very superior in yield and *C/19* × *W5* slightly so over *C/19*. Also the Master Spinner of the Myingyan Spinning Mill reported highly on the two strains, especially *L11* × *W6* corroborating the report of the Technological

Laboratory, Bombay, in the previous year. Consequently these two strains are being tried out in the districts and multiplied. The report of the Technological Laboratory is repeated for information.

Cotton	Staple length inch	Highest standard warp counts	Value above or below contract rate for Broach Extra Superfine @ Rs 182
C/19 ..	1"	10	Rs 20 off
C/19 × W5	11/16"	13	Rs 15 off
L11 × W6 ..	1"	20	Rs 10 off

*West Central Circle*—In the West Central Circle this crop is of importance only in Thayetmyo District where it is grown as a mixed crop with sesamum or with Taung ya paddy. Its area there was 55,383 acres. Experimental work on cotton was confined to Allanmyo where several hybrids and pure lines were tested.

*Distribution of the seed of three improved Wagale strains was made in Thayetmyo Minbu and Pakokku Districts.* It is reported that the yields in all the places were satisfactory.

*Rajpipla State*—The Rajpipla State has continued its policy of maintaining the improved strain (1027 A L F) as a pure crop throughout the State. No other variety is grown and the purity is maintained (1) by the annual distribution of selected seed obtained by special arrangements for the purpose (2) by the Cotton Transport Act which prohibits and penalizes the sowing or importing into the State for purposes of sowing Goghari cotton seed or any other short staple seed and (3) by the control of ginning and pressing factories for the prohibition and prevention of admixture of short staple varieties with the pure 1027 A L F crop of the State.

As the cotton crop of the Surat District wherefrom the supply of the seed of 1027 A L F was usually obtained had suffered to a very great extent from severe frost during the season of 1934 and as an appreciable portion of the local crop was already gathered before damage was caused by frost in Gujarat, the best seed of 1027 A L F was secured by careful selection from such local crop gathered prior to the advent of frost. The liberal policy of distributing the seed thus obtained by way of *Tacavi* to the cultivators of the State from different convenient depots was continued as usual and this tended to maintain the quality and outturn to all that could be desired.

One great advantage to the cultivators by the introduction of 1027 A L F variety of cotton for cultivation in the State is that whereas in the past when the short staple Goghari cotton was cultivated here in the State they were required to go some forty to fifty miles and at times still further away from their houses into British Districts to sell their cotton, now through the introduction of this measure and the success it has achieved they have found a ready market at their own doors and there is such a demand for it that even in these years of heavy depression this cotton is readily sold at comparatively good prices.

Besides, this measure has stimulated the growth of meetings for the sale of the cotton crop to the highest customer at various agricultural centres in the State, and this has resulted in cultivating a spirit of combination in the cultivators to dispose of their agricultural produce at the best prices available.

Rajpipla cotton (known by the term Jagadia cotton in the market) is now recognised as equal to the very best cotton and is largely sought after. A notable feature of the crop for the year was that even though the seed was selected from the local crop of 1027 A L F variety it had so nicely suited the soil and the crop therefrom was observed to be so highly flourishing that had it not been for the advent of frost early during the onset of the season,

the State would have been able to put forth a record output of crop for the year. Despite the most destructive character of the frost in extensive areas under cotton cultivation, the State was able to put forth nearly two thirds of its ordinary output of cotton in the market; it is also noted with gratification that the quality of this State cotton crop maintained its high standard of superiority over short staple varieties and this was evident from the fact that it commanded a very high percentage of extra price in the market. The success achieved from this experiment of cotton cultivation from the best selected seed of 1027 *A.L.F.* variety of local crop has considerably facilitated the work of the revenue authorities who have now a much wider field of selection of the best seed of this variety than they have had hitherto.

**BARODA STATE.**—(1) *Nausari District.*—The important item during the year consisted in the extension of 1027 *A.L.F.* type and eradication of inferior types of cotton like *Goghari*. Owing to the severe damage to cotton on account of frost in the middle of January, arrangements for large quantities of good cotton seed had to be made and eventually 955,580 lbs. of cotton seed was distributed through 12 seed depots. Seven of these were financed from the grant of the Indian Central Cotton Committee and the rest by the Baroda Government.

As no pedigree seed of 1027 *A.L.F.* was available from the Bombay Department, seed separately ginned under Departmental supervision, from the registered growers was distributed to 435 registered seed growers in 4 groups and this is expected to cover about 5,000 acres.

(2) *Baroda District.*—The only extension work in the district is that of the Broach 9 cotton. During the year, the seed distribution from various sources was estimated to cover an area of about 8,000 acres excluding Dabhoi Taluka, which is known to grow a good deal of Broach 9 on a considerable scale, but owing to damage by frost no further organised work could be done.

(3) *Mehsana District.*—Attempts are being made to introduce *Wagad No. 8* in place of local *Wagad*. 2,100 lb. of *Wagad 8* pure cotton seed was supplied to the cultivators but severe frost has interfered in getting any results.

(4) *Amreli District.*—*Dhulia No. 1* is being recommended for this part and 57,930 lb. of seed cotton was supplied to the cultivators covering about 3,500 acres by the Amreli Pedhi and Cotton Seed Supply Association.

**HYDERABAD STATE.**—I. *Gaorani Tract.*—Distribution of *Gaorani* seed in the protected area was continued. 1,169,338 lb. of seed for an area of about 73,090 acres was purchased by the Agricultural Department and distributed on *Tacavi* loan system to cultivators in the Nanded district.

A beginning has been made with multiplication of seed of two recently evolved superior strains of *Gaorani*, for distribution in the next year.

2. *Aurangabad District.*—Distribution of *Banilla* seed was continued, with a view to replace the inferior mixture now grown in the district. 143,040 lb. of seed sufficient for about 9,000 acres was distributed by the Agricultural Department on *Tacavi* system.

3. *Parbhani District.*—Distribution of seed of *Verum 262* was continued, with the object of replacing the present inferior variety. 18,296 lb. of seed sufficient for about 1,550 acres was distributed by the Agricultural Department.

4. *Raichur District.*—Distribution of seed of improved varieties was continued, with a view to replace the local inferior type of *Kumpla* and the mixed Dharwar-American. Seed of *Jayawant* variety amounting to 295,508 lb. sufficient for about 29,551 acres and seed of *Upland Gadag No. 1* amounting to 34,710 lb. for about 3,471 acres was distributed this year.



# **APPENDIX VI** **BALANCE SHEET AS AT 31ST MARCH 1935**

RECEIPTS.	Rs. a. p.	Rs. a. p.	EXPENDITURE	Rs. a. p.	Rs. a. p.
Cotton Cess Receipts		08 42 117	A. Administration		15 51 200
Interest Account—			B. Improvement of Cotton Marketing—		8 3
Amount received on investments	13 78 471	8 7	1 Cost of exhibits moisture tests etc.	78 161 11	
Add—Refund of income-tax deducted from interest	18 072 13 0		2 Cost of growing cotton in India	1 29 6 0	
	14 96 544	5 7	C. Seed Distribution and Extension Schemes—		2 07 837
Less—			L Bombay —		11 8
1. Interest paid in advance at the time of purchasing Government Paper (since recovered) interest on temporary overdraft and Bank's commission on collection of interest	44 124 14 1		1 Hubli	72 415 7 3	
2. Interest credited to Provident Fund account	4 895 6 2		2 Gadag	33 026 10 9	
3. Bank's withdrawal charges for securities sold	2 491 1 0		3. Cadag Supplementary	20 188 10 6	
4 Income tax on interest	20 138 3 6		4 Surat	35 213 3 1	
5 Brokerage for sterling loan sold	291 9 0		5 Alband	11 769 6 11	
6 Provision for Sinking Fund	5 848 2 0		6 Khandesh	1 19 371 12 6	
	77 800 3 9		7. Decan Canals (Banalla)	3 505 10 3	
Profit on conversion and sale of securities		14 18 744	II Madras —		
Sinking Fund account			1. Pay and allowances of Business Manager Tiruppur	13 026 15 0	
Miscellaneous Receipts		53 671 12 7	2 Co 2	15 122 12 4	
Refund from provident fund for contributions disallowed		80 833 11 10	3. HI	9 032 2 9	
Suspense Receipts		3 391 1 11	III Hyderabad	1 35 013 12 11	
		1 0 0	IV Central Provinces —	23 954 12 1	
			1 Verum cotton	73 544 2 5	
			2 Long staple	50 255 0 0	
			VI. Baroda	3 117 4 0	
			VII Lypalpur Ginny	19 039 3 3	
			D. Printing and Propaganda—		5 63 482
			1. Publicity and Propaganda	62 735 2 9	
			2. Printing and Distribution	3 460 7 8	
Carried over		1 13 54 607	Carried over		95 175 10 0
		4 9			24 22 786
					11 10

BALANCE SHEET AS AT 31st MARCH 1935—*contd.*

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RECEIPTS.	Rs. a. p.	EXPENDITURE.	Rs. a. p.	Rs. a. p.
Brought forward ..	1,13,54,007 4 9	E. <i>Statistical Research</i> — 1. Studies of village consumption of cotton .. .. 2. Forecast Improvement Scheme .. ..	.. .. 22,005 7 6 3,897 0 0	24,22,786 11 10
		II. <i>Technological Research</i> — 1. <i>Technological Laboratory</i> — A. Capital Expenditure— 1. Land and Buildings .. .. 2. Machinery .. .. 3. Freight .. .. 4. Apparatus and Equipment .. .. 5. Machinery Workshop .. .. B. Working Expenses .. .. 2. Provincial .. ..	.. .. .. .. 3,82,741 10 3 86,336 1 8 7,502 2 8 41,558 3 7 5,789 8 3 15,10,536 5 9 63,397 3 3	25,902 7 8
		III. Research Studentships .. .. IV. <i>Bombay</i> :— AGRICULTURAL RESEARCH GRANTS. 1. A. Surat Physiological .. .. 2. A. " " Writing-up .. .. B. " " Boll-worm .. .. C. " " Boll-worm Propaganda .. .. 3. A. Dharwar Wilt .. .. B. " " Writing-up .. .. 4. Khandesh Cotton Breeding .. .. 5. Co-ordination of Cotton Research .. .. 6. Jalgaon Cotton Breeding .. .. 7. Broach Cotton Breeding .. .. 8. Small Leaf Disease Survey .. .. 9. Survey of Goghari cotton in Bombay Presidency .. .. 10. Defibrillation of cotton seed in Bombay Presidency .. ..	.. .. 2,45,139 11 3 5,814 7 8 1,14,509 9 7 91,408 9 2 2,315 3 0 1,82,836 4 11 10,902 10 3 23,373 5 0 1,749 7 6 20,251 5 3 25,066 13 7 4,037 2 0 510 0 0 3,450 0 0	20,97,861 3 5 2,30,822 5 7
		V. <i>Madras</i> :— (a) Herbaceous .. .. (b) Femphears and Physiological .. .. (c) Fodder Cholam .. .. (d) Nadam Cotton Breeding .. ..	.. .. 1,12,097 5 8 94,071 12 5 10,355 5 4 4,589 6 8	
Carried over ..	1,13,54,007 4 9	Carried over ..	9,26,338 7 3	47,86,372 12 4

## BALANCE SHEET AS AT 31st MARCH 1935—cont'd

Receipts.	Rs	£	P	Expenditure	Rs	£	P
Brought forward	113,54	607	4 0	Brought forward	0 29	339	7 3
				VI. Punjab—	4 37	968	0 7
				(a) Botanical	1 56	441	13 4
				(b) Entomological	38	149	5 0
				(c) White Fly	10	5 8	3 9
				(d) Root Rot	10	812	11 3
				(e) Spraying Trials	7	00	0 0
				(f) Fertilising and Delinting	1	019	8 0
				(g) Physiological	1	011	0 0
				(h) Survey of Disease of Malformation	3,44	37	12 0
				VII. Central Provinces—	2 20	0 0	
				(a) Botanical	1 47	831	1 4
				(b) Entomological	9	752	10 0
				(c) Fruit Bait worm	13	36	313 12 0
				(d) Rohilkhand and Bundelkhand Cotton Survey	1 85	095	0 5
				(e) Institute of Plant Industry Indore	2 906	15 5	
				(f) Sind	23	42	7 9
				(g) Dunes—	1 53	328	14 4
				(h) Capital	25	815	10 3
				(i) Cotton Improvement	14	174	15 1
				(j) Botanical	31	489	6 9
				(k) Cotton Survey	31	827	15 11
				(l) Pink and Spotted Boll worm	4	251	6 3
				(m) Blight	605	0 0	
				(n) Baroda	889	0 0	
				(o) Root Rot			
				(p) Comparative Tests			
				(q) Survey of Goghart Cotton			
				(r) Dengal-Gumilla			
				XV. Bengal—			
				(a) Root Rot			
				(b) Comparative Tests			
				(c) Survey of Goghart Cotton			
				(d) Dengal-Gumilla			
				XVI. Least receivable (not considered doubtful) —			
				(1) Co-operative Cotton Sales Society Hubli	7	628	12 8
				(2) Co-operative Cotton Sales Society Gadag	7	292	0 0
				Suspense account			
				By Balance			
Total	113,54	607	4 0	Total	113,54	607	4 0

BALANCE SHEET AS AT 31st MARCH 1935.  
*Provident Fund Account.*

RECEIPTS.	Rs.	a.	p.	Rs.	a.	p.	EXPENDITURE.	Rs.	a.	p.	Rs.	a.	p.
Subscribers' contributions ..	1,62,565	5	4				By Advances to subscribers ..	31,911	3	0			
Less—Payments made to subscribers resigned ..	40,189	13	3				Less—Recoveries made upto 31st March 1935 ..	27,696	12	0			
Committee's contributions ..	1,59,010	11	7								4,214	7	0
Less—Payments made to subscribers resigned and forfeitures to the Committee and to the Lapses and Forfeitures account.	38,002	1	8				Accrued interest on Government Paper credited to subscribers' account ..				2,209	4	0
Suspense Deposit of Mr. Dutt's own contributions with interest ..	1,006	3	3½				By Balance ..				2,64,489	10	7
Suspense Receipts (Provident Fund amount of Mr. Aziz Ahmed ..	224	7	6										
Investment Fluctuation account ..				1,230	10	9							
Lapses and Forfeitures account ..				25,719	4	5							
				579	4	5							
Total ..				2,70,913	5	7	Total ..				2,70,913	5	7

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# STATEMENT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31st MARCH 1935.

Receipts.	Rs. a. p.	Payments.	Rs. a. p.	Rs. a. p.
<p>† Opening Balance .. .. .</p> <p>Receipts under Section 12 of the Indian Cotton Cess Act, 1923 .. .. .</p> <p>‡ Other Receipts .. .. .</p> <p>Interest on Investments .. .. .</p> <p>† Includes Rs. 4,728 7-0 on account of Sinking Fund and Rs. 15,355 9 3 against loans recoverable from Hubli and Gadag Co-operative Cotton Sale Societies.</p> <p>‡ Includes Rs. 1,110-11-0 against provision for Sinking Fund for the year 1934-35.</p>	<p>27,49,059 14 7</p> <p>7,32,583 14 1</p> <p>8,487 1 8</p> <p>1,31,942 5 7</p>	<p>Administration of the Committee, including Improvement of Cotton Marketing, Seed Distribution and Extension, Printing and Propaganda and Statistical Research .. .. .</p> <p>Agricultural Research .. .. .</p> <p>Technological Research .. .. .</p> <p>Closing Balance (Government Paper at cost) .. .. .</p> <p>31% Government Promissory Notes of the face value of .. Rs. 7,08,300</p> <p>31% Government of India Loan 1907-50 of the face value of .. 2,75,000</p> <p>41% Government of India Loan 1907-70 of the face value of .. 10,01,000</p> <p>41% Government of India Loan 1925-40 of the face value of .. 26,600</p> <p>5% Government of India Loan 1930-41 of the face value of .. 2,09,000</p> <p>8% Bombay Municipal Bonds 1954 of the face value of .. 50,000</p> <p>6% Karachi Port Trust Coupon Debentures 1955 of the Face value of .. .. .</p> <p>8% Viceroy Municipal Debentures 1956 of the face value of .. 1,30,000</p> <p>31% India Sterling Bearer Bonds of the face value of .. £ 20,000</p> <p>(Market value on 31st March 1935 Rs. 31,38,201-5-6)</p> <p>Imperial Bank of India Current Account .. .. .</p> <p>Imperial—Committee's Accounts as certified by the Secretary .. .. .</p> <p>Technological Laboratory .. as certified by the Director, Technological Laboratory .. .. .</p> <p>High Commissioner for India, London, for scholarship (£100) .. .. .</p> <p>Deposit with Application for 10 Reserve Bank Shares .. .. .</p> <p>Suspense (recoverable) .. .. .</p> <p>Loans Recoverable (but considered doubtful) .. .. .</p> <p>** Total Closing Balance .. .. .</p>	<p>4,43,583 2 5</p> <p>2,18,032 13 0</p> <p>9,06,285 8 10</p> <p>25,004 0 0</p> <p>1,88,664 3 6</p> <p>50,500 0 0</p> <p>2,41,212 8 0</p> <p>4,15,328 2 0</p> <p>2,20,688 14 10</p> <p>26,15,299 4 7</p> <p>15,799 10 9</p> <p>3,325 10 5</p> <p>1,000 0 0</p> <p>1,065 1 10</p> <p>11,920 12 8</p>	<p>4,08,392 12 5</p> <p>4,00,760 13 6</p> <p>1,06,468 1 9</p>
Total ..	36,23,643 3 11	Total ..	36,23,643 3 11	26,52,030 8 3

\* 4% Government of India Loan 1900-70 of the Face Value of Rs. 1,10,900 has been deposited with the Imperial Bank of India for security against any overdraft that may be required by the Committee.

\*\* That includes Rs. 5,618-2 0 on account of Provision for Sinking Fund.

We have examined the above Statement of Receipts and Payments of the Indian Central Cotton Committee with the Books, Vouchers and Certified Returns of the Committee have obtained all the information and explanations we have required and Certify that to the best of our information and explanations received the above Statement is a correct abstract of the figures appearing in the Books and is drawn up in conformity with the Rules under the Indian Cotton Cess Act, 1923.

(Sd.) S. B. Bhatnagar & Co.,  
Registered Accountants, Auditors.

BOMBAY, 30th April 1935.

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(Sd.) S. B. BILLIMORIA & Co.,  
Registered Accountants, Auditors.

**BOMBAY, 30th April 1935.**

(Sd.) S. B. BILLIMORIA & Co.,  
Registered Accountants, Auditors.

## STATEMENT SHOWING EXPENDITURE UNDER RESEARCH AND SEED EXTENSION SCHEMES UP TO MARCH 31st, 1935

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Major Heads.	1	2	Period.	3	4	5	Expenditure from Capital Grants on			8	Net working expenses for		REMARKS	
							(a)	(b)	Rs		a. p.			
		Rs	a. p.	Yrs	Mths	RESEARCH	Rs	a. p.	SCHEMES.	Rs	a. p.	Rs	a. p.	
II Technological Research—														
(1) Technological Laboratory—														
(a) Capital Expenditure		571 399	3 8			53 927 10 5	3,82 741 10 3	1 39 869 4 7		41 313 12 1	14 09 22 9 8			*Physiological Scheme closed down on 4th August 1932 and Writing-up Scheme closed down on 17th October 1933.
(b) Working Expenses		15 32 169 15 7	3 7			15 10 536 5 9		1 316 11 7		3,380 9 0	60 010 10 3			
(2) Provincial		63,597	3 3			63 397 3 3								
AGRICULTURAL RESEARCH GRANTS														
IV Bombay Scheme—														
(1) Surat Physiological and Writing up*		2 91 445	0 0	10	11	2 50 954 2 11				23 331 5 2	2 27 619 13 9			
(2) (a) Surat Boll worm		1 20 220	0 0	7	7	1 14 509 9 7				4 707 8 7	1 09 802 1 0			Scheme closed down on 31st March 1931.
(b) Writing up		2 420	0 0	0	4	2,315 3 0					2 315 3 0			
(c) , Propaganda and Clean up		1 28 764	0 0	6	0	91 468 9 2				10 829 0 11	80 640 8 3			
(3) Dharwar—														
(a) Wilt & Cotton Breeding		2 63 545	0 0	8	11	1 82 836 4 11				13 713 3 7	1 09 123 1 4			Scheme closed down on 31st July 1932 and in July 1933.
(b) Writing-up		11 855	0 0	0	10	10 902 10 3					10 902 10 3			Scheme closed down on 31st March 1933.
(4) Khandesh Cotton Breeding		27 995	0 0	5	6	26 573 5 0					26 573 5 0			Scheme closed down on 31st March 1932.
(5) Broach Cotton Breeding		65 000	0 0	5	0	25 064 13 7					2 658 1 0	22 408 12 7		
(6) Jalgaon Cotton Breeding		41 111	0 0	5	0	20 251 5 3					781 0 5	19 500 5 0		
(7) Co-ordination of Cotton Research		23 991	0 0			1 749 7 6								
(8) Survey of Small Leaf—		5 298	0 0	1	0	4 037 2 0								
(9) Disease of cotton														
(a) Survey of Gogbari Cotton in Bombay Presi dency		5 000	0 0	5	0	510 0 0				405 2 6	1 749 7 6	9 541 15 6		
(10) Dehydration of Cotton seed in Bombay Presi dency												510 0 0		
Recurring		5 250	0 0											
Non recurring		3 700	0 0											

STATEMENT SHOWING EXPENDITURE UNDER RESEARCH AND SEED EXTENSION SCHEMES UP TO MARCH 31st, 1935—*contd.*

1 MAJOR HEADS.	2 Total sanctioned grant.	3 Period.	4 Date of starting of work.	5 Total expenditure up to 31st March 1935.	Expenditure from Capital Grants on			8 Expenditure from annual grants on apparatus and equipment of a permanent or semi-permanent nature.	9 Net working expenses, i.e., staff, field experiments, labour, stores, laboratory and field contingencies including petty apparatus.	10 REMARKS.
					(a) Lands and buildings.	(b) Machinery, apparatus and other moveable property.	7			
					Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
<b>V. Madras Schemes.—</b>										
(1) Herbaceum..	1,47,068 0 0	14 6	Dec. 1923	1,12,097 5 8	....	....	....	4,420 10 3	1,07,676 11 5	
(2) Pemphres and Physiological ..	2,12,779 0 0	7 0	Sept. 1931	64,671 12 5	....	....	....	6,234 11 10	58,437 0 7	
(3) Fodder Cholam—										
(a) Capital ..	900 0 0	5 5	Jan. 1931	10,355 5 4	{	881 11 7	....	270 1 11	9,203 7 10	
(b) Recurring ..	16,800 0 0				....	....	....	388 14 0	4,200 8 8	
(4) Nadam Cotton Breeding ..	13,730 0 0	5 0	June 1933	4,589 6 8	....	....	....	31,484 2 4	3,75,223 3 3	†Rs. 2,030 transferred to Capital from Working grant.
<b>VI. Punjab Schemes.—</b>										
(1) Botanical—										
(a) Capital Expenditure ..	31,330 0 0	14 8	Aug. 1925	4,37,968 0 7	{	9,102 11 0	....	....	....	
(b) Working Expenses ..	†6,85,650. 0 0				....	....	....	....	....	
(2) Entomological—										
(a) Capital Expenditure ..	6,000 0 0	10 11	May 1926	1,56,441 13 4	{	5,826 3 10	....	....	....	
(b) Working Expenses (Pink and Spotted Boll-worm) ..	2,40,410 0 0				....	....	....	8,935 1 0	1,41,630 8 6	
(3) White Fly ..	56,087 0 0	4 11	May 1931	38,149 5 0	....	....	....	9,245 15 6	23,903 5 6	
(4) Root-Rot ..	42,206 0 0	6 0	Sept. 1932	10,578 3 9	....	....	....	91 14 6	10,486 5 3	
(5) Spraying Trials ..	14,400 0 0	2 0	July 1933	10,812 11 3	....	....	....	3,028 5 3	7,784 6 0	
(6) Physiological ..	1,46,833 0 0	5 0	March 1935	1,919 8 0	....	....	....	....	1,910 8 0	
(7) Defibration and Delinting Plants—										
(a) Recurring ..	1,000 0 0	....	....	1,000 0 0	....	....	....	....	1,000 0 0	†Rs. 827-6-0 since refunded.
(b) Non-recurring ..	6,700 0 0	....	....	6,700 0 0	....	†5,872 10 0	....	....	....	
(8) Survey of disease of mal-formation ..	2,674 0 0	1 0	June 1934	1,911 0 0	....	....	....	....	\$1,911 0 0	\$Rs. 180-5-0 since refunded.
<b>VII. Central Provinces—</b>										
(1) Botanical ..	††61,000 0 0	2 6	Oct. 1923	3,44,737 12 6	....	....	....	4,605 12 10	3,40,131 15 8	††The balance of this amounting to Rs. 3,100-13-5 lapsed on revision.
(2) Entomological ..	{ 5,36,150 0 0 6,773 0 0	13 0 2 0	April 1926 July 1934	2,220 0 0	....	....	....	84 2 0	2,135 14 0	



## STATEMENT SHOWING EXPENDITURE UNDER RESEARCH AND SEED EXTENSION SCHEMES UP TO MARCH 31st 1935—contd

Major Heads.	Total sanctioned grant.	Period.	Date of starting of work.	Total expenditure up to 31st March 1935	Expenditure from Capital Grants on			Expenditure from annual grants on apparatus and equipment of permanent and semi permanent nature	Net working expenses of staff field experiments labour stores, laboratory and field contingencies including petty apparatus	REMARKS
					(a) Lands and buildings	(b) Machinery apparatus and other moveable property	(c) Schemes—(contd)			
1	2	3	4	5	6	7	8	9	10	
VIII. United Provinces—										
(1) Pink Boll worm Scheme—										
(a) Capital Expenditure	54 000 0 0	8 0	July 1925(a)	147 834 1 4			47 933 12 0	3 005 4 3	00 735 0 4	(a) Scheme closed down on 31st July 1931
(b) Working Expenses	50 000 0 0	7 91	Oct. 1926(b)	9 732 10 0				12 3 3 1	8 479 6 11	(b) Scheme closed down on 12th July 1931
(2) Boll-hand and Bundelkhand Cotton Survey	13 800 0 0	3 0	July 1933							
IX. Institute of Plant Industry, Indore—										
(a) Capital Expenditure	63 883 555 12 10	Permanent	O.L. 1924	13 36 313 12 0	2,12,532 11 5	70 033 1 5		31 857 4 4	10 70 9,0 10 10	(c) Re Rs 50 202 12 10 transferred from Rs 100 000 grant to Capital
(b) Working Expenses	10 50 807 15 2							29 537 5 6	1 68 557 10 11	
X. Sind	274 316 0 0	9 9	July 1927	1 85 005 0 5				39 70 6 0	21 272 1 9	
XI. Burma—										
(a) Capital Expenditure	3 000 0 0	6 0	April 1931	2 004 15 5			2 004 15 5	6 403 9 21	1 51 865 5 2	† Figures subject to revision on receipt of Annual Return for 1931-35
(b) Cotton Improvement	49 032 0 0	4 10	May 1929	25 242 7 9				149 6 71	25 668 3 8	
XII. Hyderabad—										
(a) Botanical	3 59 817 0 0	3 11	June 1931	1 58 303 14 4						
(b) Cotton Survey	39 165 0 0	4 10	June 1931	25 815 10 3						
(c) Pink and Spotted Boll worm	42 400 0 0	3 0	June 1933	14 174 15 1				123 22 211	14 031 2 2	
XIII. Bikaner—										
(a) Capital Expenditure	14 500 0 0	5 0	Jan. 1931	31 489 6 9	8 584 6 9	3 735 1 9			10 169 14 3	
(b) Working Expenses	38 200 0 0	5 0	Feb. 1932	31 877 15 11				2 031 15 8	29 846 0 3	
XIV. Baroda—										
(a) Root Rot	58 179 0 0	3 0	April 1932	4 251 5 3				145 11 6	4 105 9 9	
(b) Comparative tests of 1027 & 1A cottons	4 280 0 0	1 2	Feb. 1933	505 0 0					505 0 0	
(c) Survey of Goghar Cotton	5 000 0 0	5 0	Not started Dec. 1931	889 0 0					774 12 0	
(d) Plant Fuller Proprietary	9 350 0 0	2 0	Not started							
(e) Bental Combs Cotton	18 510 0 0	5 0								
(f) Mysore (Doddabakshi) Cotton	8,412 0 0	3 0								

# I. C. SEED DISTRIBUTION AND EXTENSION SCHEMES.

MAJOR HEADS.	1	2	3	4	5	Expenditure from Capital Grants on		8	Net working expenses, i.e., staff, field experiments, labour, stores, laboratory and field contingencies including petty apparatus.	REMARKS.						
						(a)	(b)									
		Rs.	a.	p.	Yrs.	Mths.	Date of starting of the Scheme.	Total expenditure up to 31st March 1935.	Rs.	a.	p.	Rs.	a.	p.		
1. <i>Bombay</i> —																
(i) Hubli .. ..	..	50,110	0	0	0	0	June 1930	32,445 7 3	....	....	....	32,445	7	3	Scheme closed down on 10th June 1935.	
(ii) Gadag .. ..	..	54,515	0	0	6	0	Do.	33,026 10 9	....	....	....	33,026	10	9		
(iii) Gadag Supplementary ..	..	21,448	0	0	4	0	June 1931	20,188 10 0	....	....	....	17,259	5	0		
(iv) Haveri .. ..	..	27,752	0	0	5	0	....	11,786 0 11	....	....	....	10,781	8	11	Not started.	
(v) Athani .. ..	..	46,757	0	0	5	0	April 1932	....	....	....	....	....	....	....		
(vi) Bailhongal .. ..	..	27,425	0	0	5	0	....	....	....	....	....	....	....	....		
(vii) Surat .. ..	..	96,050	0	0	0	0	April 1930	35,213 3 1	....	....	....	35,213	3	1	Recoveries amounting to Rs. 1,10,000 are anticipated from this scheme.	
(viii) Khandesh .. ..	..	*2,70,340	0	0	5	0	May 1931	1,10,371 12 5	....	....	....	1,09,213	6	0		
(ix) Deccan Canals (Banilla) ..	..	423,800	0	0	5	0	April 1931	3,503 10 3	....	....	....	3,503	10	3		
(x) B. D. 8 Cotton .. ..	..	10,400	0	0	3	0	....	....	....	....	....	....	....	....	Not started. This scheme is self-supporting due to anticipated recoveries.	
2. <i>Madras</i> —																
(i) Pay and allowances of the Business Manager, Tiruppur .. ..	..	21,050	0	0	5	0	May 1931	13,023 15 0	....	....	....	12,837	11	0		
(ii) Co. 2. .. ..	..	81,310	0	0	5	0	Sept. 1932	15,132 12 4	....	....	....	15,018	15	4	(b) Scheme closed down on 16th July 1931.	
(iii) H. 1. .. ..	..	18,800	0	0	(b) 2	0	May 1933	3,952 2 0	....	....	....	3,952	2	0		
3. <i>Punjab</i> —Lyalpur Ginnery .. ..	..	18,125	0	0	8	....	....	16,035 3 3	....	....	....	1,23,301	7	5		
4. <i>Sind</i> .. ..	..	3,89,510	0	0	0	0	April 1931	1,33,913 12 11	....	....	....	....	....	....	Scheme closed down on 30th April 1931.	
5. <i>Hyderabad State</i> .. ..	..	32,400	0	0	6	0	March 1930	23,951 12 1	....	....	....	23,034	12	1		
6. <i>Central Provinces</i> —																
(a) Verum Cotton .. ..	..	1,17,000	0	0	3	8	Sept. 1930	73,544 2 5	....	....	....	73,544	2	5	Scheme closed down on 30th April 1931.	
(b) Extension of long staple and marketing of Verum Cotton ..	..	1,25,528	0	0	3	0	April 1931	30,235 0 0	....	....	....	30,235	0	0		
7. <i>Baroda</i> .. ..	..	25,000	0	0	5	0	Do.	3,117 4 0	....	....	....	2,999	12	0		
8. <i>United Provinces</i> —																
C. 402 .. ..	..	45,800	0	0	5	0	May 1935	....	....	....	....	....	....	....		

Scheme closed down on 10th June 1935.

Not started.

Recoveries amounting to Rs. 1,10,000 are anticipated from this scheme.

Not started.

This scheme is self-supporting due to anticipated recoveries.

Scheme closed down on 16th July 1934.

Scheme closed down on 30th April 1934.

## APPENDIX VII.

## INDIAN RAW COTTON CONSUMED IN INDIAN MILLS

(Based on Returns made under the Indian Cotton Cess Act 1923 by Mills in British India and on Voluntary Returns from or Yarn Production figures of Mills in Indian States)

Cotton Year 1st September to 31st August

(In Bales of 400 lb Nett)

	1923-24	1924-25	1925-'06	1926-27	1927-28	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34	1934-35
Bombay Island	762,610	987,355	731,937	747,033	435,426	542,036	766,375	694,546	611,006	565,081	491,709	637,237
Ahmedabad	262,745	273,639	294,800	264,139	293,075	318,093	314,051	321,503	302,257	318,009	373,345	326,553
Bombay Presidency	1,180,410	1,434,417	1,189,539	1,167,892	894,671	1,014,905	1,300,859	1,173,659	1,130,645	1,116,297	1,063,549	1,230,616
Madras	149,721	162,876	176,274	185,007	194,591	201,284	211,488	214,730	260,707	292,013	278,060	312,164
United Provinces	160,622	177,064	191,740	204,702	170,846	182,462	231,005	235,623	256,800	273,575	277,230	292,424
Central Provinces and Berar	94,035	106,032	109,925	111,292	116,883	101,591	123,146	118,492	115,018	111,008	112,660	125,014
Bengal	72,535	83,553	77,949	89,763	80,086	81,212	92,075	91,993	100,390	103,784	107,633	101,101
Punjab and Delhi	23,393	30,683	35,394	40,687	45,638	51,575	61,464	73,786	89,681	80,854	71,939	83,897
Rest of British India	12,227	14,414	17,313	13,190	15,040	22,189	24,458	27,101	30,342	31,935	35,139	33,675
Total—British India	1,693,438	1,909,069	1,798,204	1,812,733	1,519,760	1,714,038	2,057,605	1,935,363	1,987,603	2,009,664	1,946,210	2,183,701
Total—Indian States	142,505	175,609	187,614	229,443	251,539	277,540	315,399	333,996	358,793	351,260	390,116	428,341
Total—India	1,835,943	2,174,678	1,985,818	2,042,176	1,771,349	1,991,578	2,373,004	2,269,359	2,346,396	2,360,924	2,336,326	2,612,132

**INDIAN RAW COTTON CONSUMED IN MILLS IN INDIAN STATES.**  
(Based on Voluntary Returns from or Yarn Production figures of Mills in Indian States).

*Cotton Year : 1st September to 31st August.*

(In Bales of 400 lb. Nett.)

	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.
Hyderabad .. ..	15,210	16,697	19,067	20,823	23,074	31,290	33,488	33,231	45,588
Mysore .. ..	43,571	44,320	30,019	40,500	43,326	40,293	50,596	47,108	51,196
Baroda .. ..	46,070	46,884	48,852	59,043	62,578	53,534	50,587	53,612	57,146
Gwalior .. ..	24,257	25,716	36,708	41,463	45,207	45,892	43,306	49,362	56,318
Indore .. ..	53,526	65,391	70,070	83,026	88,620	95,206	91,036	111,430	111,229
Kathiawar States .. ..	}	}	}	{	20,283	18,849	18,868	26,506	35,438
Other Indian States .. ..					32,558	39,382	40,209	45,197	45,735
Pondicherry .. ..					18,350	20,257	23,170	23,610	22,691
Total .. ..	229,443	251,589	277,540	315,399	333,996	358,793	351,260	390,116	428,341

**LOOSE (UNPRESSED) INDIAN RAW COTTON RECEIVED IN SPINNING MILLS IN BRITISH INDIA.**

(Based on Voluntary Returns furnished by Mills).

*Cotton Year : 1st September to 31st August.*

(In Bales of 400 lbs. Nett.)

	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.
Bombay .. ..	28,328	24,970	27,321	24,361	54,409	74,979	80,092	74,893	59,355
Madras .. ..	35,193	39,560	52,188	46,582	55,717	99,389	96,340	110,875	123,260
United Provinces .. ..	16,991	10,308	13,878	20,441	18,496	14,367	10,236	17,871	10,090
Central Provinces and Berar .. ..	40,762	20,861	6,924	16,243	15,771	29,743	17,462	18,382	20,544
Punjab .. ..	3,910	4,739	3,760	4,301	4,307	2,317	2,149	..	5,535
Total .. ..	125,189	100,438	104,074	111,988	148,700	211,795	215,279	221,996	217,784

## APPENDIX VIII.

STOCKS OF INDIAN RAW COTTON HELD IN INDIA BY THE MILLS  
AND THE TRADE ON 31st AUGUST, 1934 & 1935.

(In thousand bales\* of 400 lb each)

Trade Descriptions of Cotton	TRADE STOCKS ON 31ST AUGUST								Mill Stocks on 31st August		Total Indian Trade and Mill Stocks on 31st Aug	
	Bombay Island		Karachi		Rest of India		Total India		Total India		1934	1935
	1934	1935	1934	1935	1934	1935	1934	1935	1934	1935		
BENGALS—												
United Provinces	—	—	—	—	(a) 16	(a) 9	16	9	20	23	36	32
Punjab	—	—	64	27	(b) 8	(b) 4	72	31	10	8	82	39
Sind	—	—	61	14	—	—	51	14	4	3	55	17
Rajputana	—	—	3	1	—	(c) 1	3	2	17	15	20	17
Others (Unclassified)	90	65	—	—	—	(c) 1	90	66	3	3	93	69
Total	90	65	118	42	24	15	232	122	54	52	286	174
OMRAS—												
Central Provinces Oomras	21	19	—	—	(d) 1	(d) 15	22	24	27	32	49	56
Barar Oomras	60	24	—	—	(e) 15	(e) 14	75	38	16	11	91	49
Khandesh—Banilla	—	—	—	—	—	—	—	—	6	13	6	13
Khandesh Oomras	45	19	—	—	—	(f) 4	45	23	16	15	61	38
Central India—Malva	—	—	—	—	—	—	—	—	22	18	22	18
Central India—Others	36	14	—	—	(g) 7	(g) 4	43	18	12	10	65	28
Barar and Nagar Oomras	26	14	—	—	(h) 1	(h) 4	27	18	7	11	34	29
Total	188	90	—	—	24	31	212	121	106	110	318	231
VERUM 262	—	—	—	—	—	—	—	—	10	6	10	6
HYDERABAD GAORANI	1	—	—	—	(h) 27	(h) 10	28	10	67	52	95	62
Total	1	—	—	—	27	10	28	10	77	68	105	68
AMERICANS—												
Punjab—289 F	—	—	—	—	—	—	—	—	10	6	10	6
Punjab (Unspecified—4 F)	7	13	34	39	(b) 6	(b) 23	47	75	60	44	107	119
Sind—289 F	—	—	2	7	—	—	2	7	6	10	7	17
Sind (Unspecified—4 F)	2	17	6	4	—	—	8	21	13	19	21	40
Dharwar (Gadag 1)	—	—	—	—	—	—	—	—	3	6	3	6
Dharwar (Upland—Unspecified)	—	—	—	—	—	—	—	—	3	1	3	1
Cambodia (Coimbatore No 2)	—	—	—	—	—	—	—	—	55	61	55	61
Cambodia (Unspecified)	20	9	—	—	—	—	20	9	33	35	53	44
Total	29	39	42	50	6	23	77	112	182	182	259	294
BROACH—												
Surat Navsari (Surti)	6	8	—	—	—	—	6	8	56	26	62	34
Broach (Unspecified)	76	22	—	—	(c) 4	(c) 6	80	28	49	50	129	58
Total	82	30	—	—	4	6	86	36	105	56	191	92
DHOLLERAS—												
Mattheo	28	18	—	—	—	—	28	18	2	6	30	23
Cutch	—	—	—	—	—	—	—	—	1	2	1	2
Wagad	—	—	—	—	—	—	—	—	42	32	42	32
Dhollerias (Unspecified)	46	27	—	—	(c) 8	(c) 7	54	34	10	10	64	44
Total	74	45	—	—	8	7	82	62	65	49	137	101
SOUTHERNS—												
Kumtias (Jayawant)	—	—	—	—	—	—	—	—	19	20	19	20
Kumtias (Unspecified)	—	—	—	—	—	—	—	—	64	51	64	51
Westerns (Jowari and Mungari)	56	22	—	—	—	(f) 9	56	34	50	42	125	104
Northern	—	—	—	—	—	(f) 3	—	—	19	28	—	—
Cocansadas (& Warangal)	—	—	—	—	—	(f) 14	—	14	3	5	3	19
Karunganni	—	—	—	—	—	—	—	—	15	20	15	20
Tinnevelly	3	6	—	—	—	—	3	6	30	24	33	30
Salems	—	—	—	—	—	—	—	—	3	2	3	2
Unclassified	33	14	—	—	—	—	33	14	—	—	33	14
Total	92	42	—	—	—	26	92	68	203	192	295	260
COWILLAS	—	—	—	—	—	—	—	—	—	—	—	—
BURMAS (Wagale & Wagyi)	—	1	—	—	—	—	—	1	3	1	3	2
OTHER SORTS (Unclassified)	6	10	1	—	1	—	8	10	4	—	12	10
Total Indian Cotton	662	322	161	92	94	118	817	532	789	700	1 606	1 232

\*Standard Indian bales of approximate average gross weight 400 lb and net weight 392 lb of cleaned (lint) cotton

N.B.—Detailed Statement of Mill stocks on the 31st August 1935, is attached.

- (a) At Cawnpore. (e) In Indore and Gwalior States  
 (b) In the Punjab (f) In Hyderabad State  
 (c) At Ahmedabad † Includes 682 bales held at Ahmedabad.  
 (d) In the Central Provinces (g) In the Madras Presidency  
 (e) In Barar  
 (f) In F & W Khandesh districts

## STOCKS OF RAW COTTON HELD BY THE

(Compiled from Voluntary

(In thousand bales\*

Trade Descriptions of Cotton.	Bombay Island.	Ahmedabad.	Rest of Bombay Presidency.	Total Bombay Presidency.	Madras North.	Madras South.	Total Madras Presidency.	United Provinces.	Central Provinces.	Berar.	Total C. P. & Berar.	Bengal.
<b>BENGALS—</b>												
United Provinces .. ..	2	—	—	2	—	—	—	10	1	—	1	2
Punjab .. ..	3	—	—	3	—	—	—	1	—	—	—	1
Sind .. ..	2	—	1	3	—	—	—	—	—	—	—	—
Rajputana .. ..	2	—	—	2	—	—	—	—	—	—	—	—
Others .. ..	2	—	—	2	—	1	1	—	—	—	—	—
Total ..	11	—	1	12	—	1	1	11	1	—	1	3
<b>OMRAS—</b>												
Central Provinces Oomras ..	4	—	1	5	—	1	1	1	20	1	21	3
Berar Oomras .. ..	2	1	—	3	—	—	—	2	3	2	5	1
Khandesh—Banilla .. ..	—	—	13	13	—	—	—	—	—	—	—	—
Khandesh Oomras .. ..	4	—	8	12	—	—	—	—	1	2	3	—
Central India—Malvi .. ..	2	3	—	5	—	—	—	1	—	—	—	—
Central India—Others .. ..	3	—	—	3	—	—	—	2	1	—	1	—
Barsi and Nagar Oomras ..	1	—	4	5	—	—	—	—	—	—	—	—
Total ..	16	4	26	46	—	1	1	6	25	5	30	4
<b>VERUM 262 .. ..</b>	1	—	—	1	—	—	—	—	3	1	4	—
<b>HYDERABAD GAORANI ..</b>	7	—	19	26	6	—	6	—	9	1	10	—
Total ..	8	—	19	27	6	—	6	—	12	2	14	—
<b>AMERICANS—</b>												
Punjab—289-F .. ..	5	—	—	5	—	—	—	—	—	—	—	—
Punjab (Unspecified—4-F) ..	5	—	1	6	—	7	7	22	—	—	—	3
Sind—289-F .. ..	7	1	—	8	—	—	—	—	—	—	—	1
Sind (Unspecified—4-F) ..	3	—	1	4	—	12	12	—	—	—	—	1
Dharwar (Gadag 1) .. ..	3	1	1	5	—	1	1	—	—	—	—	—
Dharwar (Upland—Unspecified) ..	—	—	1	1	—	—	—	—	—	—	—	—
Cambodia (Coimbatore No. 2) .. ..	8	—	—	8	2	46	48	—	1	1	2	2
Cambodia (Unspecified) ..	16	1	—	17	2	11	13	—	—	—	—	1
Total ..	47	3	4	54	4	77	81	22	1	1	2	8
<b>BROACH—</b>												
Surat—Navsari (Surti) ..	7	10	1	18	—	—	—	—	1	—	1	—
Broach (Unspecified) ..	12	12	2	26	—	1	1	—	—	—	—	1
Total ..	19	22	3	44	—	1	1	—	1	—	1	1
<b>DHOLLERAS—</b>												
Mattheo .. ..	4	—	—	4	—	—	—	—	—	—	—	—
Cutch .. ..	—	2	—	2	—	—	—	—	—	—	—	—
Wagad .. ..	3	21	1	25	—	—	—	—	—	—	—	—
Dholleras (Unspecified) ..	7	3	—	10	—	—	—	—	—	—	—	—
Total ..	14	26	1	41	—	—	—	—	—	—	—	—
<b>SOUTHERNS—</b>												
Kumtias (Jayawant) ..	10	1	2	13	5	—	5	—	1	—	1	—
Kumtias (Unspecified) ..	16	1	10	27	8	—	8	—	—	—	—	1
Westerns (Jowari and Mungari) .. ..	12	2	6	20	7	—	7	—	—	—	—	1
Northerns .. ..	1	2	—	3	20	1	21	—	—	—	—	—
Cocanadas (& Warangal) ..	—	1	1	2	1	—	1	—	—	—	—	—
Karunganni .. ..	2	1	1	4	—	14	14	—	—	—	—	1
Tinnevellies .. ..	3	1	—	4	—	20	20	—	—	—	—	—
Salems .. ..	1	—	—	1	—	1	1	—	—	—	—	—
Total ..	45	9	20	74	41	36	77	—	1	—	1	3
<b>COMILLAS</b>	—	—	—	—	—	—	—	—	—	—	—	—
<b>BURMAS (Wagale &amp; Wagyi)</b>	—	—	—	—	—	—	—	—	—	—	—	—
<b>OTHER SORTS</b> .. ..	—	—	—	—	—	—	—	—	—	—	—	—
Total Indian Cotton ..	160	64	74	298	51	116	167	39	41	8	49	19
<b>AMERICANS</b> .. ..	28	2	—	30	—	—	—	—	—	—	—	—
<b>EGYPTIANS</b> .. ..	8	9	1	18	1	—	1	—	—	—	—	1
<b>EAST AFRICANS</b> .. ..	18	21	5	44	—	—	—	1	—	—	—	2
<b>OTHERS</b> (Sudan, Mesopotamia, etc.) .. ..	6	2	1	9	—	—	—	—	—	—	—	—
Total Foreign Cotton ..	60	34	7	101	1	—	1	1	—	—	—	3
<b>Grand Total</b> ..	220	98	81	399	52	116	168	40	41	8	49	22

\* Standard Indian bales of approximate average gross weight 400 lb.

## MILLS IN INDIA ON 31st AUGUST, 1935.

Returns furnished by Mills )  
of 400 lb. each )

Punjab and Delhi	Rest of British India	Total British India	Hyderabad	Mysore	Baroda	Gwalior	Indore	Kathawar States	Other Indian States	Pondicherry	Total Indian States	Grand Total	Trade Descriptions of Cotton
5	—	20	—	—	—	3	—	—	—	—	3	23	BENGALS—
1	—	8	—	—	—	—	—	—	—	—	—	8	United Provinces
—	11	3	—	—	—	—	—	—	—	—	—	3	Punjab
—	—	13	—	—	—	—	1	—	1	—	2	15	Sind
—	—	3	—	—	—	—	—	—	—	—	—	3	Rajputana
—	—	—	—	—	—	—	—	—	—	—	—	—	Others
6	13	47	—	—	—	3	1	—	1	—	5	52	Total
—	—	31	—	—	—	—	—	—	1	—	1	32	OOMRAS—
—	—	11	—	—	—	—	—	—	—	—	—	11	Central Provinces Oomras
—	—	13	—	—	—	—	—	—	—	—	—	13	Barar Oomras
—	—	15	—	—	—	—	—	—	—	—	—	15	Khandesh—Banilla
—	—	6	—	—	1	3	6	—	12	—	12	18	Khandesh Oomras
—	—	6	—	—	—	—	4	—	—	—	4	10	Central India—Malvi
—	—	6	6	—	—	—	—	—	—	—	6	11	Central India—Others
—	—	—	—	—	—	—	—	—	—	—	—	—	Barsi and Nagar Oomras
—	—	87	6	—	1	3	10	—	3	—	23	110	Total
—	—	6	—	—	—	—	—	—	1	—	1	6	VERUM 262
—	—	42	9	—	—	—	1	—	—	—	10	52	HYDERABAD GAORANI
—	—	47	9	—	—	—	1	—	1	—	11	58	Total
1	—	6	—	—	—	—	—	—	—	—	—	6	AMERICANS—
3	—	43	—	—	—	—	—	—	—	—	—	44	Punjab—280 F
—	—	9	—	—	—	—	—	—	—	1	1	10	Punjab (Unspecified 4 F)
—	—	17	—	—	—	1	—	—	—	1	12	19	Sind—280 F
—	—	6	—	—	—	—	—	—	—	—	—	6	Sind (Unspecified—4 F)
—	—	1	—	—	—	—	—	—	—	—	—	1	Dharwar (Gadag 1)
—	—	—	—	—	—	—	—	—	—	—	—	—	Dharwar (Upland—Unspecified)
—	—	60	—	1	—	—	—	—	—	—	1	61	Cambodia (Colombatore No 2)
—	—	31	—	1	—	—	—	—	1	2	4	35	Cambodia (Unspecified)
4	2	173	—	2	—	1	—	—	2	4	9	182	Total
—	—	19	—	—	2	1	2	2	—	—	7	26	BROACH—
—	—	23	—	—	—	—	—	—	—	2	2	30	Surat Navsari (Surti)
—	—	47	—	—	2	1	2	2	—	2	9	56	Broach (Unspecified)
—	—	47	—	—	2	1	2	2	—	2	9	56	Total
—	—	4	—	—	—	—	—	1	—	—	1	5	DHOLLERAS—
—	—	2	—	—	—	—	—	—	—	—	—	2	Mattheo
—	—	25	—	—	2	—	—	5	—	—	7	32	Cutch
—	—	10	—	—	—	—	—	—	—	—	—	10	Wagad
—	—	—	—	—	—	—	—	—	—	—	—	—	Dhollerass (Unspecified)
—	—	41	—	—	2	—	—	6	—	—	8	49	Total
—	—	19	—	1	—	—	—	—	—	—	1	20	SOUTHERNS—
—	—	36	—	14	1	—	—	—	—	—	15	51	Kumtias (Jayawant)
—	—	—	—	—	—	—	—	—	—	—	—	—	Kumtias (Unspecified)
—	—	23	1	11	—	—	—	—	1	1	14	42	Westerns (Jowari and Mungari)
—	—	24	—	3	—	—	—	—	—	1	4	23	Northern
—	—	3	1	—	—	—	—	—	—	1	2	6	Cocanadas (& Warangal)
—	—	19	—	—	—	—	—	1	—	—	1	20	Karunganni
—	—	24	—	—	—	—	—	—	—	—	—	24	Tinnevelles
—	—	2	—	—	—	—	—	—	—	—	—	2	Salems
—	—	155	2	29	1	—	—	1	1	3	37	192	Total
—	—	—	—	—	—	—	—	—	—	—	—	—	COMILLAS
—	1	1	—	—	—	—	—	—	—	—	—	1	BURMAS (Wagale & Wagy)
—	—	—	—	—	—	—	—	—	—	—	—	—	OTHER SORTS
10	16	693	17	31	6	8	14	9	8	9	102	700	Total Indian Cotton
—	—	80	—	—	—	—	—	—	—	1	1	31	AMERICANS
—	—	20	—	3	2	—	—	—	—	—	5	25	EGYPTIANS
—	—	47	—	—	5	—	—	1	—	—	6	53	EAST AFRICANS
1	—	10	—	1	—	—	—	—	—	—	1	11	OTHERS (Sudan, Mesopotamia, etc.)
1	—	107	—	4	7	—	—	1	—	1	13	120	Total Foreign Cotton
11	16	705	17	35	13	8	14	10	8	10	115	820	Grand Total

and net weight 392 lb. of cleaned (lint) cotton.

STOCKS OF "SALEMS," "CAMBODIAS," AND "TINNEVELLIES" HELD IN THE  
MADRAS PRESIDENCY, BY THE MILLS AND THE TRADE  
ON 31st JANUARY 1935.

(In thousand bales of 400 lb. nett.)

Trade descriptions of cotton.	Mill stocks.	Trade stocks.	Total stocks.
Tinnevellies .. .. .	21	7	28
Salems .. .. .	10	2	12
Cambodias .. .. .	42	11	53
Total ..	73	20	93



## APPENDIX IX.

## EXPORTS BY SEA OF INDIAN RAW COTTON CLASSIFIED BY VARIETIES

(Compiled from Voluntary Returns furnished by Exporters)

1st September 1934 to 31st August 1935

(In thousand bales\* of 400 lb each)

Trade Descriptions of Cotton	Exported to				Total Exports
	Europe (excluding United Kingdom) and the West	United Kingdom.	Japan.	China and the East (excluding Japan)	
<b>BENGALS—</b>					
United Provinces	5	1	19	2	27
Punjab	184	42	230	42	498
Sind	129	83	42	2	256
Rajputana	11	3	4	1	19
Others (Unclassified)	50	31	24	—	105
<b>Total</b>	<b>379</b>	<b>110</b>	<b>319</b>	<b>47</b>	<b>855</b>
<b>COMRAS—</b>					
Central Provinces—Comras	38	21	82	—	141
Berar—Comras	80	7	224	5	296
Khandesh—Ban Ila	—	—	2	—	2
Khandesh—Comras	40	3	172	20	235
Central India—Malvi	10	—	1	—	11
Central India—Others	8	1	41	10	60
Barsi and Nagar—Comras	8	3	62	8	81
Unclassified	23	10	97	—	130
<b>Total</b>	<b>157</b>	<b>45</b>	<b>681</b>	<b>43</b>	<b>926</b>
<b>VERUM 202</b>	—	—	—	—	—
<b>HYDERABAD GAORANI</b>	1	—	1	—	2
<b>Total</b>	<b>1</b>	<b>—</b>	<b>1</b>	<b>—</b>	<b>2</b>
<b>AMERICANS—</b>					
Punjab—289 F	3	4	—	—	7
Punjab (Unspecified—4 F)	143	126	219	8	496
Sind—289 F	—	1	—	—	1
Sind (Unspecified—4 F)	13	16	14	2	45
Dharwar (Gadag I)	—	—	3	—	3
Dharwar (Upland—Unspecified)	—	—	2	—	2
Cambod a (Coimbatore No 2)	3	1	—	—	4
Cambodia (Unspecified)	4	4	8	—	16
<b>Total</b>	<b>166</b>	<b>152</b>	<b>246</b>	<b>10</b>	<b>574</b>
<b>BROACH—</b>					
Surat Navsari (Surt)	3	—	1	—	4
Broach (Unspecified)	46	5	16	—	67
<b>Total</b>	<b>49</b>	<b>5</b>	<b>17</b>	<b>—</b>	<b>71</b>
<b>DROLLERS—</b>					
Mattheo	34	2	60	3	89
Cutch	—	—	4	—	4
Wagad	2	—	2	—	4
DROLLERS (Unspecified)	3	—	27	—	30
<b>Total</b>	<b>39</b>	<b>2</b>	<b>83</b>	<b>3</b>	<b>127</b>
<b>SOUTHERNS—</b>					
Kumtas (Jayawant)	—	—	—	—	—
Kumtas (Unspecified)	—	—	1	—	1
Westerns (Jowari and Munguri)	7	1	10	1	19
Northerns	12	—	—	—	12
Cocanadas (and Warangal)	8	9	—	—	17
Karunganni	10	1	5	—	16
Tinnevelles	18	2	27	2	49
Salems	1	—	—	—	1
<b>Total</b>	<b>56</b>	<b>13</b>	<b>43</b>	<b>3</b>	<b>115</b>
<b>COMILLAS</b>	29	7	12	1	49
<b>BURMAS (Wagale and Wagys)</b>	3	—	4	—	7
<b>OTHER SORTS</b>	12	2	102	6	122
<b>Grand Total</b>	<b>891</b>	<b>336</b>	<b>1 508</b>	<b>113</b>	<b>2 848</b>
Total exports as per official returns from British Indian and Kathiawar Ports—Bales of 400 lb net	991	374	1 622	128	3 115

\* Standard Indian bales of approximate average gross weight 400 lb and net weight 392 lb of cleaned (lint) cotton.

## APPENDIX

RECEIPTS AT MILLS IN INDIA OF  
(Compiled from Returns  
1st September 1934 to  
(In thousand bales\*)

Trade Descriptions of Cotton.*	Bombay Island.	Ahmedabad.	Rest of Bombay Presidency.	Bombay Presidency.	Madras Presidency.	United Provinces.	C. P. & Berar.	Bengal.	Punjab and Delhi.	Rest of British India.
<b>BENGALS—</b>										
United Provinces .. .. .	12	—	—	12	—	52	2	12	18	—
Punjab .. .. .	18	—	3	21	—	6	1	3	24	5
Sind .. .. .	9	1	2	12	—	—	—	1	—	3
Rajputana .. .. .	20	—	—	20	—	1	—	—	—	15
Others .. .. .	5	—	2	7	1	11	—	1	—	—
<b>Total ..</b>	<b>64</b>	<b>1</b>	<b>7</b>	<b>72</b>	<b>1</b>	<b>69</b>	<b>3</b>	<b>17</b>	<b>42</b>	<b>23</b>
<b>OOMRAS—</b>										
Central Provinces Oomras .. .. .	23	1	2	26	2	10	37	20	—	—
Berar Oomras .. .. .	15	—	—	15	—	6	9	4	—	—
Khandesh—Banilla .. .. .	3	1	13	17	—	—	1	—	—	—
Khandesh—Oomras .. .. .	17	1	20	44	—	—	9	—	—	—
Central India—Malvi .. .. .	9	12	2	23	—	6	—	—	—	—
Central India—Others .. .. .	23	2	5	30	—	21	—	—	—	—
Barsi and Nagar Oomras .. .. .	4	—	13	17	—	—	1	—	—	—
<b>Total ..</b>	<b>94</b>	<b>17</b>	<b>61</b>	<b>172</b>	<b>2</b>	<b>43</b>	<b>57</b>	<b>24</b>	<b>—</b>	<b>—</b>
VERUM 262 .. .. .	3	1	—	4	—	—	13	1	—	—
HYDERABAD GAORANI .. .. .	19	—	40	59	2	—	20	—	—	—
<b>Total ..</b>	<b>22</b>	<b>1</b>	<b>40</b>	<b>63</b>	<b>2</b>	<b>—</b>	<b>33</b>	<b>1</b>	<b>—</b>	<b>—</b>
<b>AMERICANS—</b>										
Punjab—289-F .. .. .	12	—	—	12	1	8	—	6	1	—
Punjab (Unspecified—4-F) .. .. .	18	—	1	19	17	51	—	15	28	4
Sind—289-F .. .. .	18	2	2	22	—	—	—	1	—	—
Sind (Unspecified—4F) .. .. .	10	2	1	19	24	9	—	3	—	—
Dharwar (Gadag 1) .. .. .	11	1	11	23	—	—	—	—	—	—
Dharwar (Upland—Unspecified) .. .. .	4	—	3	7	—	—	—	1	—	—
Cambodia (Coimbatore No. 2) .. .. .	14	3	1	18	88	—	1	6	—	—
Cambodia (Unspecified) .. .. .	47	2	—	49	20	1	—	5	—	—
<b>Total ..</b>	<b>140</b>	<b>10</b>	<b>19</b>	<b>169</b>	<b>159</b>	<b>69</b>	<b>1</b>	<b>37</b>	<b>29</b>	<b>4</b>
<b>BROACH—</b>										
Surat-Navsari (Surti) .. .. .	32	43	4	79	—	—	2	2	—	—
Broach (Unspecified) .. .. .	83	36	2	121	1	—	—	1	—	3
<b>Total ..</b>	<b>115</b>	<b>79</b>	<b>6</b>	<b>200</b>	<b>1</b>	<b>—</b>	<b>2</b>	<b>3</b>	<b>—</b>	<b>3</b>
<b>DHOLLERAS—</b>										
Mattheo .. .. .	18	2	—	20	—	—	—	—	—	—
Cutch .. .. .	4	5	2	11	—	—	—	—	—	—
Wagad .. .. .	12	95	2	109	—	—	—	—	—	—
Dholleras (Unspecified) .. .. .	23	12	1	36	—	—	—	—	—	—
<b>Total ..</b>	<b>57</b>	<b>114</b>	<b>5</b>	<b>176</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>
<b>SOUTHERNS—</b>										
Kumptas (Jayawant) .. .. .	28	2	5	35	3	—	1	1	—	—
Kumptas (Unspecified) .. .. .	58	2	25	85	3	1	—	1	—	—
Westerns (Jowari and Mungari) .. .. .	57	13	25	95	14	5	—	6	—	—
Northern .. .. .	3	6	—	9	20	—	—	1	—	—
Cocanadas (& Warangal) .. .. .	2	3	1	6	4	—	—	1	—	—
Kurunganni .. .. .	3	3	1	7	30	—	—	2	—	—
Tinnevellies .. .. .	5	1	1	7	36	—	—	3	—	—
Salems .. .. .	4	1	—	5	7	—	—	—	—	—
<b>Total ..</b>	<b>100</b>	<b>31</b>	<b>58</b>	<b>249</b>	<b>117</b>	<b>6</b>	<b>1</b>	<b>15</b>	<b>—</b>	<b>—</b>
<b>COMILLAS</b> .. .. .	—	—	—	—	—	—	—	—	—	—
BURMAS (Wagale & Wagyi) .. .. .	—	—	—	—	—	—	—	1	—	14
OTHER SORTS .. .. .	—	—	—	—	3	—	—	—	—	—
<b>Total Indian Cotton ..</b>	<b>652</b>	<b>253</b>	<b>196</b>	<b>1,101</b>	<b>285</b>	<b>187</b>	<b>97</b>	<b>98</b>	<b>71</b>	<b>44</b>
<b>AMERICANS</b> .. .. .	48	12	1	61	1	—	—	1	—	—
<b>EGYPTIANS</b> .. .. .	62	40	3	105	2	—	—	3	1	—
<b>EAST AFRICANS</b> .. .. .	60	98	11	169	1	1	1	10	3	—
<b>OTHERS (Sudan, Mesopotamia, etc.)..</b>	23	5	2	30	—	—	—	1	—	—
<b>Total Foreign Cotton ..</b>	<b>193</b>	<b>155</b>	<b>17</b>	<b>365</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>15</b>	<b>4</b>	<b>—</b>
<b>Grand Total ..</b>	<b>845</b>	<b>408</b>	<b>213</b>	<b>1,466</b>	<b>289</b>	<b>188</b>	<b>98</b>	<b>113</b>	<b>75</b>	<b>44</b>
Indian raw cotton consumed in Indian mills. (Figures compiled mainly from returns under the Indian Cotton Cess Act—Bales of 400 lb. net) .. .. .	687	327	217	1,231	312	292	125	101	84	39

\* Standard Indian bales of approximate average

## X.

## RAW COTTON CLASSIFIED BY VARIETIES.

(furnished by Mills).

31st August 1935.

of 400 lb. each).

Total British India.	Hyderabad	Mysore.	Barrida.	Gwalior.	Indore.	Kathiawar States.	Other Indian States.	Pondicherry.	Total Indian States.	Grand Total.	Trade Descriptions of Cotton.
96	—	—	—	12	—	—	1	—	13	109	BENGALS—
59	—	—	—	—	—	—	—	—	—	59	United Provinces
16	—	—	—	—	—	—	—	—	—	16	Punjab
36	—	1	—	—	5	—	8	—	18	54	Sind
20	—	—	—	—	—	—	—	—	—	20	Rajputana
											Others
227	—	1	2	14	5	—	9	—	31	258	Total
95	1	—	—	—	—	—	4	—	5	100	OMRAS—
34	—	—	—	—	—	—	—	—	—	34	Central Provinces Oomras
18	—	—	—	—	—	—	1	—	—	19	Derar Oomras
53	—	—	1	—	—	—	1	—	2	55	Khandesh—Banilla
29	—	—	—	—	—	—	9	—	77	106	Khandesh Oomras
51	—	—	—	—	—	—	—	—	37	83	Central India—Malvi
18	9	—	—	—	—	—	1	—	10	23	Central India—Others
											Barsi and Nagar Oomras
203	10	—	5	21	77	—	16	1	133	431	Total
18	—	—	1	—	1	—	—	1	3	21	VERUM 262
81	31	—	—	—	1	—	1	—	33	114	HYDERABAD GAORANI.
99	31	—	1	—	2	—	1	1	36	135	Total
23	—	—	—	1	—	—	1	—	2	30	AMERICANS—
131	—	—	—	—	—	—	3	—	5	139	Punjab—239-F
23	—	—	—	—	1	1	—	—	2	25	Punjab (Unspecified—4-F)
55	—	—	—	10	—	—	—	—	12	67	Sind—239-F
23	—	—	1	—	—	—	—	—	1	24	Sind (Unspecified—4-F)
8	—	—	—	—	—	—	—	—	—	8	Dharwar (Gadag 1)
113	—	1	—	—	—	—	3	3	7	120	Dharwar (Upland—Unspecified)
84	—	2	—	—	—	—	—	—	4	89	Cambodia (Coimbatore No. 2)
											Cambodia (Unspecified)
463	—	3	1	11	1	1	9	7	33	501	Total
83	—	—	—	4	11	5	1	1	23	106	BROACH—
126	—	—	5	—	—	1	1	3	10	130	Surat-Narsari (Surti)
											Broach (Unspecified)
209	—	—	9	1	11	6	2	4	33	242	Total
20	—	—	—	—	—	2	—	—	2	22	DHOLLERAS—
11	—	—	—	—	—	—	—	—	—	11	Mattheo
109	—	—	10	—	—	18	2	—	30	139	Cutch
36	—	—	2	—	—	—	—	—	2	38	Wagad
											Dhollerars (Unspecified)
176	—	—	12	—	—	20	2	—	34	210	Total
40	—	12	1	—	—	—	—	—	13	53	SOUTHERNS—
90	—	11	1	—	—	1	2	—	15	105	Kumtias (Jayawant)
120	3	14	—	—	—	1	3	3	21	141	Kumtias (Unspecified)
30	—	2	1	—	—	—	1	4	4	34	Westerns (Jowari and Mungari)
11	6	—	—	—	—	—	—	2	7	18	Northern
39	—	—	—	—	—	—	1	—	1	40	Cocanadas (& Warangal)
46	—	9	—	—	—	—	—	—	9	55	Karunganni
12	—	—	—	—	—	—	—	—	—	12	Tinnevelly
											Salema
388	8	48	3	—	—	1	4	6	70	459	Total
15	—	—	—	—	—	—	—	—	—	15	COMILLAS
3	—	—	—	—	—	—	1	—	1	4	BURMAS (Wagale & Wagyl)
											OTHER SORTS
1,883	49	52	33	50	95	28	44	10	371	2,254	Total Indian Cotton
63	—	—	—	—	—	—	—	1	1	64	AMERICANS
111	—	6	6	—	—	—	—	—	12	123	EGYPTIANS
185	—	—	22	—	1	4	—	—	27	212	EAST AFRICANS
31	—	—	1	—	—	—	1	—	2	33	OTHERS (Sudan, Mesopotamia, etc.)
390	—	6	29	—	1	4	1	1	42	432	Total Foreign Cotton
2,273	49	58	62	50	97	32	45	20	413	2,686	Grand Total
2,184	46	51	57	56	114	35	46	23	423	2,612	Indian raw cotton consumed in Indian mills. (Figures compiled mainly from returns under the Indian Cotton Cess Act—Bales of 400 lb. net)

gross weight 400 lb. and net weight 392 lb. of cleaned (lint) cotton.

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

TECHNOLOGICAL LABORATORY, BOMBAY—*contd.*

11. Junior Research Assistant	..	..	Dr. K. R. Sen, D.Sc. (Dacca)	..	..	Research Scholar, Technological Laboratory, and Technological Assistant, Lyallpur.
12. Statistician and Personal Assistant	..	..	Mr. V. Venkataraman, M.A. (Madras)	..	..	Statistical Assistant, Labour Office, Government of Bombay, Bombay.
13. Temporary Chemist	..	..	Dr. Lavji Thoria, Dr. Ing. (Germany)	..	..	—
14. Electrician	..	..	Mr. Herculano Lobo, L.E.E. (V.J.T.I.)	..	..	—
15. Spinning Assistant	..	..	Mr. N. Iyengar	..	..	—
16. Senior Tester	..	..	Mr. H. B. Joshi, B.Sc.	..	..	—
17. Senior Tester	..	..	Mr. S. S. Sukthankar, L.T.C. (V.J.T.I.)	..	..	—
18. Junior Tester	..	..	Mr. K. G. Deo	..	..	—
19. Junior Tester	..	..	Mr. R. G. Panwalkar, B.Sc.	..	..	—
20. Junior Tester	..	..	Mr. G. D. Bhide, B.Sc...	..	..	—
21. Junior Tester	..	..	Mr. K. V. N. Nayar	..	..	—
22. Junior Tester	..	..	Mr. V. N. Modak, B.Sc.	..	..	—
23. Junior Tester	..	..	Mr. L. V. Sundaraman, B.A.	..	..	—
24. Junior Tester	..	..	Mr. P. S. Sambamurthy	..	..	—
25. Junior Tester	..	..	Mr. G. J. Kharkar, B.Sc.	..	..	—
26. Junior Tester	..	..	Mr. Sassoon Samson, B.Sc.	..	..	—
27. Junior Tester	..	..	Mr. A. J. Farid	..	..	—
28. Junior Tester	..	..	Mr. U. K. Benegal, B.A.	..	..	—

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

TECHNOLOGICAL LABORATORY, BOMBAY—*contd.*

29	Junior Tester	..	..	..	Mr. P. V. Nachane, B.Sc.	..	..	..	—
30	Junior Tester	..	..	..	Mr. A. B. Khan, B.Sc.	..	..	..	—
31.	Junior Tester	..	..	..	Mr. C. S. Ramanathan, B.Sc.	..	..	..	—
32.	Junior Tester	..	..	..	Mr. M. R. Raut, M.Sc.	..	..	..	—
33.	Draughtsman	..	..	..	Mr. B. G. Mehta	..	..	..	—
34.	Statistical Clerk	..	..	..	Mr. R. Krishna Iyer	..	..	..	—
35.	Statistical Clerk	..	..	..	Mr. P. K. Wagle	..	..	..	—
36.	Mechanic	..	..	..	Mr. J. B. Kharas	..	..	..	—

INSTITUTE OF PLANT INDUSTRY, INDORE.

37.	Director	..	..	..	Mr. F. Keith Jackson, N.D.A. (Hons.), Dip. Agri. (Cantab.).	..	Director of Research Department of Agriculture, Iraq (1923-30).
38.	Geneticist and Botanist	..	..	..	Mr. J. B. Hutchinson, M.A. (Cantab.)	..	Assistant Geneticist and Botanist, Trinidad (1926-33).
39.	Chemist and Agronomist	..	..	..	Mr. Y. D. Wad, M.A., M.Sc. (Bombay), A.I.I.Sc.	..	Research Student, Indian Central Cotton Committee.
40.	Extension Officer	..	..	..	Mr. Misri Lal Saxena, L.Ag. (Cawnpore)	..	Six years as Assistant Farm Superin- tendent, United Provinces Subordi- nate Agricultural Service.
41.	Farm Superintendent	..	..	..	Mr. G. C. Tambe, B.Ag. (Bombay)	..	—
42.	Plant Breeding Assistant	..	..	..	Mr. Kuber Singh, B.Ag. (Bombay)	..	—
43.	Senior Botanical Assistant	..	..	..	Mr. R. L. M. Ghose, M.Sc. (Allahabad)	..	—

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

INSTITUTE OF PLANT INDUSTRY, INDORE—*contd.*

		Mr S C. Taleara, B Ag. (Bombay)	Research Student, Indian Central Cotton Committee
44.	Assistant Farm Superintendent	..	—
45.	Junior Farm Assistant	.. Mr K M Simlote, B Ag (Nagpur)	—
46.	Personal Assistant	.. Mr A N Srivastava, M Sc (Lucknow)	—
47.	Statistical Assistant	.. Mr V G Panse, B Sc (Bombay)	—
48.	Genetical Assistant	.. Mr Bholanath, M Sc (Punjab)	—
49.	Junior Plant Breeding Assistant (Temporary).	.. Mr N S Apte, B Ag (Bombay)	—
50.	Chemical and Agronomical Assistant	.. Mr I Madhusudan Rao, B A (Hons)	—
51.	Artist	.. Mr J S Oncar	—

BOMBAY RESEARCH SCHEMES.

(i) *Broach Cotton Breeding Scheme.*

52.	Cotton Breeder	.. Mr P L Patel, M Sc (Iowa, U S A)	—
53.	Botanical Assistant	.. Mr A K Shah, B Ag (Bombay)	On deputation from Bombay Department of Agriculture.
54.	Pathological Assistant	.. Mr Y S Kulkarni, B Ag (Bombay)	—

(ii) *Jalgaon Cotton Breeding Scheme.*

55.	Botanical Assistant	.. Mr V L. Bhosekar, B Ag. (Bombay)	On deputation from Bombay Department of Agriculture.
56.	Pathological Assistant	.. Mr J D Ranadive, B Ag (Bombay)	Research Student, Indian Central Cotton Committee.

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

BOMBAY SEED DISTRIBUTION SCHEMES.

(i) *Hubli Scheme.*

57. Agricultural Overseer .. .. Mr. B. S. Patil, B.Ag. (Bombay) .. .. —

(ii) *Gadag Scheme.*

58. Agricultural Overseer .. .. Mr. B. S. Tadsur, B.Ag. (Bombay) .. .. —

(iii) *Surat Scheme.*

59. Cotton Assistant .. .. Mr. V. D. Desai .. .. On deputation from Bombay Department of Agriculture.

60. Cotton Assistant .. .. Mr. V. V. Patel, B.Ag. (Bombay) .. .. Do. do.

(iv) *Athani Scheme.*

61. Agricultural Overseer .. .. Mr. B. M. Dhumma, B.Ag. (Bombay) .. .. —

(v) *Khandesh (Banilla) Scheme.*

62. Cotton Superintendent, Amalner .. .. Mr. S. V. Shevde, L.Ag. .. .. On deputation from Bombay Department of Agriculture.

63. Agricultural Overseer .. .. Mr. R. B. Nimbalkar, B.Ag. (Bombay) .. .. Do. do.

64. Superintendent, Bhadgaon Farm .. .. Mr. D. M. Kulkarni, B.Ag. (Bombay) .. .. Do. do.

BOMBAY COTTON FORECAST IMPROVEMENT SCHEME.

65. Provincial Officer .. .. Mr. G. R. Ambekar, School Final .. .. On deputation from Bombay Department of Agriculture.

SIND PHYSIOLOGICAL RESEARCH SCHEME.

66. Cotton Physiologist, Sakrand .. .. Mr. B. M. Dabral, M.Sc. (Benares) .. .. —

67. Senior Assistant .. .. Dr. A. M. Shaikh, M.Sc. (Bombay), Ph.D. (London), D.I.C., A.I.C. .. .. —

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd*

SIND PHYSIOLOGICAL RESEARCH SCHEME—*contd*

68	Junior Assistant	Mr Rustom M Ranji Dip Ag (Bombay)	—	
69	Junior Assistant	Mr H W Mughal Dip Ag (Bombay)	On deputation from Bombay Department of Agriculture	
70	Junior Assistant	Mr T J Malkani MSc (with distinction) (Bombay)	—	
71	Statistical Assistant	Mr S S Chitney, B Sc (Agra)	—	

SIND SEED DISTRIBUTION SCHEME

72	Cotton Supervisor, Indus Right Bank Dadu	Mr H A Idnani, B Ag (Bombay)	Research Student Indian Central Cotton Committee, on deputation from Sind Department of Agriculture	
73	Cotton Supervisor, Indus Left Bank, Mirpurkhas	Mr Ghulam Mustafa Practical Experience in Agriculture	On deputation from Sind Department of Agriculture	
74	Senior Assistant to Cotton Supervisor, Indus Left Bank	Mr Agha Khan Mahomed, 2 years Lyallpur Course	Do	do
75	Senior Assistant to Cotton Supervisor, Indus Right Bank	Mr W P Shahani B Ag (Bombay)	Do	do
76	Junior Assistant to Cotton Supervisor Indus Right Bank	Mr Lekhraj	Do	do
77	Junior Assistant to Cotton Supervisor, Indus Right Bank	Mr W R Shahani	—	
78	Junior Assistant to Cotton Supervisor, Indus Right Bank	Mr A M Kureshi	—	
79	Junior Assistant to Cotton Supervisor, Indus Right Bank	Mr Premising T Advani	—	



LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

SIND SEED DISTRIBUTION SCHEME—*contd.*

80.	Junior Assistant to Cotton Supervisor, Indus Left Bank.	Mr. Partabsingh J. Bakshi	..	..	—
81.	Junior Assistant to Cotton Supervisor, Indus Left Bank.	Mr. S. A. Sidiki, Dip. Agri. (Bombay)	..	..	—
82.	Junior Assistant to Cotton Supervisor, Indus Left Bank.	Mr. K. S. Tharumal	..	..	On deputation from Sind Department of Agriculture.
83.	Junior Assistant to Cotton Supervisor, Indus Left Bank.	Mr. T. T. Naraindas	..	..	—
84.	Junior Assistant to Cotton Supervisor, Indus Left Bank.	Mr. Atmaram	..	..	—
85.	Junior Assistant to Cotton Supervisor, Indus Left Bank.	Mr. Nek Mahomed	..	..	—
86.	Junior Assistant to Cotton Supervisor, Indus Left Bank.	Mr. Suleman	..	..	—

CENTRAL PROVINCES RESEARCH SCHEMES.

(i) *Botanical Scheme.*

87.	Economic Botanist for Cotton	..	Mr. D. N. Mahta, B.A. (Oxon.), F.L.S.	..	On deputation from Central Provinces Department of Agriculture.
88.	Assistant to Economic Botanist for Cotton.		Mr. S. C. Roy, L.Ag., and Post-Graduate, Pusa.	Do.	do.
89.	Assistant to Economic Botanist for Cotton.		Mr. S. S. Pande, M.Sc. (Punjab)	..	Research Student, Indian Central Cotton Committee.
90.	Assistant to Economic Botanist for Cotton.		Mr. D. G. Sawargaonkar, L.Ag. (Hons.)	..	On deputation from Central Provinces Department of Agriculture.
91.	Assistant to Economic Botanist for Cotton.		Mr. D. L. Janoria, L.Ag. (Hons.)	..	Do. do.

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st 1935—*contd*

CENTRAL PROVINCES BOTANICAL RESEARCH SCHEME—*contd*

92 Assistant to Economic Botanist for Mr D Y Bhand L Ag (Hons) Cotton — On deputation from Central Provinces Department of Agriculture

93 Assistant to Economic Botanist for Mr V N Paranjpe B Sc Cotton —

(ii) *Entomological Scheme*

94 Agricultural Assistant Mr M S Patil B Ag —

COMBINED LONG STAPLE COTTON AND MARKETING OF VERUM COTTON SCHEMES IN C P AND BERAR

95 Agricultural Assistant Mr J P Tiwari B Ag —

96 Agricultural Assistant Mr L P Khare B Ag —

97 Agricultural Assistant Mr G N Wardadkar B Ag —

98 Agricultural Assistant Mr L B Deshpande B Ag —

99 Agricultural Assistant Mr N B Chincholkar B Ag —

100 Agricultural Assistant Mr J N Kelkar B Ag —

101 Agricultural Assistant Mr G C Tiwari Certificate Course of Agricultural College Nagpur —

102 Agricultural Assistant Mr W R Patwardhan B Ag —

103 Agricultural Assistant Mr K S S Chowdhary B Ag —

104 Agricultural Assistant Mr L B Deshpande B Ag —

105 Agricultural Assistant Mr Mohammad Ishaq B Ag —

106 Agricultural Assistant Mr N P Konher B Ag —

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

COMBINED LONG-STAPLE COTTON AND MARKETING OF VERUM COTTON SCHEMES IN C.P. AND BERAR—*contd.*

107. Agricultural Assistant .. .. Mr. N. K. Galande, B.Ag. .. .. —

MADRAS RESEARCH SCHEMES.

(i) *Herbaceum Scheme.*

108. Senior Assistant .. .. Mr. R. Balasubramania Ayyar, B.A., B.Sc. On deputation from Madras Department of Agriculture.  
109. Junior Assistant .. .. Mr. G. Seshadri Ayyangar, M.A. .. .. —  
110. Junior Assistant .. .. Mr. V. Ramaswami Mudaliar, B.A. .. .. —  
111. Sub-Assistant .. .. Mr. D. Devasirvatham, S.S.L.C. (Botany) On deputation from Madras Department of Agriculture.

(ii) *Pentpheres and Physiological Scheme.*

112. Bio-Chemist .. .. Dr. S. Kasinatha Ayyar, B.A., Ph.D. On deputation from Madras Department of Agriculture.  
113. Physiological Botanist .. .. Mr. T. R. Narayana Ayyar, B.A. (Cantab.), B.Sc. (Ag.) Do. do.  
114. Assistant Botanist .. .. Mr. K. Dharma Rajulu, M.Sc. (Bombay) .. Research Student, Indian Central Cotton Committee.  
115. Assistant Botanist .. .. Mr. N. G. Narayanan, B.Sc.(Ag.). .. .. —  
116. Assistant Entomologist .. .. Mr. V. Margabandu, M.A. .. .. On deputation from Madras Department of Agriculture.  
117. Assistant Entomologist .. .. Mr. P. S. Narayanaswami, B.Sc. (Ag.) .. Do. do.  
118. Assistant Chemist .. .. Mr. K. Satharishi, B.Sc.(Ag.) .. .. —

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

MADRAS RESEARCH SCHEMES—*contd.*

(iii) <i>Fodder Cholam Scheme</i>			
119	Assistant	Mr M R Balakrishnan, B A, B Sc (Agrl).	On deputation from Madras Department of Agriculture
120	Assistant	Mr S Sundaram, B A, B Sc (Agrl)	Do do
(iv) <i>Breeding of Nadam Cotton.</i>			
121	Assistant	Mr R Krishnamurthi, B Sc (Ag)	Do do

MADRAS SEED DISTRIBUTION SCHEMES

(i) *Pay of Business Manager*

122	Business Manager, Tiruppur operative Trading Society, Ltd	Co-Mr K Avudanayakam Pillai, S S L C, L Ag	On deputation from Madras Department of Agriculture
(ii) <i>Co 2 Scheme</i>			
123	Agricultural Demonstrator	Mr Damodara Prabhu, B Sc (Agrn)	Do do
124	Agricultural Demonstrator	Mr L Krishnan, B A, B Sc (Agrn)	Do do
125	Agricultural Demonstrator	Mr P P Syed Mohamed, B Sc (Agrn)	Do do
126	Agricultural Assistant	Mr P N Muthuswami, B Sc (Agrn)	Do do
127	Agricultural Assistant	Mr T S Lakshmanan, B Sc (Agrn)	Do do

PUNJAB RESEARCH SCHEMES

(i) *Botanical Scheme*

128	Cotton Research Botanist	Mr Mohd Afzal B Sc (Agrn) (Punjab), A I C T A (Trinidad)	Research Student, Indian Central Cotton Committee, and State Research Scholar On deputation from Punjab Department of Agriculture
129	Assistant to Cotton Research Botanist	Chaudhri Mohammad Akbar, L Ag	On deputation from Punjab Department of Agriculture

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

PUNJAB RESEARCH SCHEMES—*contd.*

(i) *Botanical Scheme*—*contd.*

130.	Agricultural Assistant	..	..	..	Mr. Saroop Singh, L.Ag., M.Sc. (Texas), U.S.A.	On deputation from Punjab Department of Agriculture.
131.	Agricultural Assistant	..	..	..	Bh. Autar Singh, B.Sc. (Agri.)	—
132.	Agricultural Assistant	..	..	..	Mr. Akbar Ali, B.Sc. (Post-Graduate)	Research Student, Indian Central Cotton Committee. On deputation from Punjab Department of Agriculture.

133.	Agricultural Assistant	..	..	..	Bh. Santokh Singh, B.Sc. (Agri.)	—
134.	Agricultural Assistant	..	..	..	Ch. Mohammad Rashid Khan, L.C. Course, Munshi Fazil, F.A. (Punjab University).	On deputation from Punjab Department of Agriculture.
135.	Statistical Assistant	..	..	..	Mr. Bhagat Ram Sehgal, M.A. (Punjab)	—

(ii) *Entomological (Pink and Spotted Boll-worm) Scheme.*

136.	Assistant Cotton Entomologist	..	..	..	Mr. M. Haroon Khan, B.Sc. (Hons.) (London), A.R.C.S. (London).	—
137.	Field Assistant, Research Work	..	..	..	Mr. Ladha Ram, B.Sc.	—
138.	Field Assistant, Research Work	..	..	..	L. Ganda Ram, B.Sc., F.E.L.	—
139.	Field Assistant	..	..	..	Mr. Piare Mohan, B.Sc. (Hons.), M.Sc.	—
140.	Field Assistant	..	..	..	Mr. Manzoor Abbas, B.Sc. (Agri.)	—
141.	Field Assistant	..	..	..	Mr. Ghulam Ullah, B.Sc. (Agri.)	—
142.	Field Assistant	..	..	..	Mr. Dharm Bir Kohli, B.Sc. (Agri.)	—
143.	Junior Research Assistant	..	..	..	Mr. Abdul Ghani, B.Sc. (Agri.)	—
144.	Statistical Assistant	..	..	..	Mr. Prithvi Nath, B.Sc. (Agri.)	—

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

PUNJAB RESEARCH SCHEMES—*contd.*

(iii) *White Fly Scheme*

145.	Assistant Cotton Entomologist	..	L Kedar Nath Trehan, M Sc (Punjab)	..	Research Student, Indian Central Cotton Committee
146.	Field Assistant	..	..	Mr Hari Chand, B Sc (Agri)	..

(iv) *Root Rot Scheme.*

147.	Assistant Cotton Mycologist	..	Dr R. S Vasudeva, B Sc Ph D (London), D I C (London)	---
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(v) *Physiological (Periodic Partial Failure) Scheme.*

148.	Plant Physiologist	..	..	Prof. R. H. Dastur, M Sc, F.L.S.	..	On deputation from Bombay Educational Department.
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149.	Bio-Chemist	..	..	Dr. A V Varadrama Iyengar, D Sc. (Madras), A I D Sc, A I C	---
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150.	Agricultural Assistant	..	..	Mr Abdul Ahad, B Sc (Agri)	..	---
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151.	Agricultural Assistant	..	..	Bh Such Singh, B Sc (Agri)	..	---
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152.	Statistician	..	..	Mr Kewal Kishan, M A	..	---
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UNITED PROVINCES, ROHILKHAND AND BUNDELKHAND SURVEY SCHEME.

153.	Agricultural Inspector	..	..	Mr Attar Sing, L Ag. (Cawnpore)	..	On deputation from the United Provinces Department of Agriculture
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HYDERABAD RESEARCH SCHEMES.

(i) *Botanical Scheme*

154.	Cotton Research Botanist	..	..	Rai Sahib Kalidas Sawhney, M Sc. (Punjab)	..	Late Cotton Breeder in the Department of Agriculture, Iraq, Baghdad
155.	Assistant Cotton Research Botanist	..	..	Mr. D. V. Narayanayya, Dip. Agri. (Poona)	..	On deputation from Bombay Department of Agriculture.

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*contd.*

HYDERABAD RESEARCH SCHEMES—*contd.*

(i) *Botanical Scheme—contd.*

156. Assistant Cotton Research Botanist .. Mr. V. K. Bederker, B.A. (Madras), B.Ag. (Bombay). On deputation from H. E. H. the Nizam's Department of Agriculture.

157. Inspector, Variety Testing Stations .. Mr. N. R. Yardi, B.Ag. (Bombay) .. ..

(ii) *Cotton Survey Scheme.*

158. Assistant Botanist .. .. Mr. B. B. Mulchandani, B.Ag. (Bombay) .. On deputation from Bombay Department of Agriculture.

159. Graduate Assistant .. .. Mr. M. A. Jaleel, B.Sc. (Agri.) (Coimbatore) ..

(iii) *Hyderabad (Pink and Spotted Boll-worm) Scheme.*

160. Cotton Entomologist .. .. Mr. H. D. Nangpal, M.Sc. (Punjab) .. .. Research Student, Indian Central Cotton Committee and Assistant Entomologist, United Provinces Pink Boll-worm Scheme.

161. Senior Research Assistant .. .. Mr. N. T. Nadkerny, B.Ag. (Bombay), Post-Graduate Course in Entomology at Poona Agricultural College.

162. Junior Research Assistant .. .. Mr. T. E. Krishnaswamy, B.Sc. (Agri.) (Coimbatore).

HYDERABAD SEED DISTRIBUTION SCHEME.

163. Inspector .. .. Mr. M. V. Chitnis .. ..

BARODA ROOT ROT SCHEME.

164. Cotton Breeder .. .. Mr. M. S. Pandya, B.Ag. (Bombay), B.Sc. .. On deputation from Bombay Department of Agriculture.

165. Breeding Assistant .. .. Mr. A. F. Patel, B.Ag. (Bombay) ..

166. Mycological Assistant .. .. Mr. G. H. Desai, B.Ag. (Bombay) ..

LIST OF SCIENTIFIC AND TECHNICAL OFFICERS PAID FROM THE INDIAN CENTRAL COTTON COMMITTEE'S FUNDS AS ON AUGUST 31st, 1935—*concl'd.*

BIKANER GANG CANAL SCHEME

167. Cotton Assistant .. . Mr Arjan Singh, B Sc .. . . . —

168. Mechanic .. . Mr. Jagr Singh .. . . . —

*Bengal Comilla Cotton Scheme*

169. Agricultural Officer .. . Mr H. K Majumdar, M Sc. .. . . . —

TECHNOLOGICAL ASSISTANTS PAID BY INDIAN CENTRAL COTTON COMMITTEE.

170. Under Cotton Specialist, Coimbatore .. Mr. R. L N Iyengar, B Sc .. . Research Student, Indian Central Cotton Committee.

171. Under Cotton Breeder, Dharwar .. Mr H R Nayak, Inter Science (Madras) .. Formerly Junior Tester at Technological Laboratory, Bombay

172. Under Cotton Research Botanist, Lyallpur. Mr K. G. Deo .. . Do do.

173. Under Deputy Director of Agriculture, Gujarat, Surat. Mr Sunagabhushana, B Sc (Mysore) .. Research Student, Indian Central Cotton Committee.

174. Under Botanist, Agricultural Research Station, Sakrand .. Mr K S Marar, B A., LL.B. .. Formerly Junior Tester at Technological Laboratory, Bombay.



# APPENDIX XII.

## RESEARCH STUDENTSHIPS.

Year of appointment.	Name.	Where posted on appointment.	Branch of Cotton Research in which scholarship granted.	How now employed.	REMARKS.
1923	Sohan Singh Bindra, M.Sc., Honours School (Punjab).	Lyallpur	.. .. Cotton Entomology	....	Late Assistant Entomologist, Pink Bollworm Research Scheme, Punjab. Recently in Agricultural Department, Kenya.
"	Mohammed Afzal, B.Sc. (Punjab).	Do.	.. .. Cotton Botany (Plant Breeding).	Punjab Agricultural Department. Cotton Research Botanist. Punjab Botanical Research Scheme.	Indian Central Cotton Committee.
"	Sheo Shankar Pande, M.Sc. (Punjab).	Nagpur	.. .. Do.	.. Assistant to Economic Botanist for Cotton, Central Provinces Botanical Research Scheme.	Do.
"	Jiwan Singh, M.Sc. (Punjab).	Do.	.. .. Cotton Mycology	.. Reader in Botany, Khalsa College, Amritsar.	Late Senior Mycological Assistant, Central Provinces Wilt Investigation Scheme.
"	Ilabanto Banerji, M.Sc. (Calcutta).	Coimbatore..	.. .. Cotton Botany	.. University Lecturer in Botany, Calcutta University, from 31st January 1929.	Held a Senior Research Studentship under Dr. M. A. Sampathkumaran, M.A., Ph.D., Central College, Bangalore, and at the Institute of Plant Industry, Indore, from April 1926 to March 1928.



RESEARCH STUDENTSHIPS—*contd.*

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Year of appointment.	Name.	Where posted on appointment.	Branch of Cotton Research in which scholarship granted.	How now employed.	REMARKS.
1925	Kidar Nath Trehan, M.Sc. (Punjab).	Lyalpur ..	Cotton Entomology.	Punjab Agricultural Department, Assistant Cotton Entomologist, White Fly Investigation Scheme, Punjab.	Held Senior Research Studentship for study of "White Fly" problem at Khanewal. Indian Central Cotton Committee.
"	S. E. Kumana, B.A., M.Sc. (Bombay).	Technological Research Laboratory, Matunga, Bombay.	Cotton Technology.	....	Technological Assistant, Dharwar, up to 31st July 1929. Went abroad for further study.
"	J. D. Ranadive, B.Ag. (Bombay).	Dharwar ..	Cotton Mycology ..	Pathological Assistant, Cotton Breeding Scheme, Jalgaon, Khandesh. ....	Indian Central Cotton Committee.
"	P. K. Roy, M.Sc. (Dacca)	Technological Research Laboratory, Matunga, Bombay.	Textile Physics ..	....	Resigned in July 1925.
"	K. R. Sen, M.Sc. (Dacca)	Do. ..	Do. ..	Technological Assistant, Lyallpur.	Indian Central Cotton Committee. Obtained a Doctorate (D.Sc.) in 1934.
"	L. N. Rao, M.Sc. (Calcutta).	Do. ..	Cotton Microscopy..	Lecturer in Botany, Central College, Bangalore.	Resigned in August 1926.
1926	D. F. Kapadia, B.A. (Bombay), M.Sc. (Tech.), (Manchester).	Do. ..	Cotton Technology ..	Head of the Textile Manufactures Department, Victoria Jubilee Technical Institute, Bombay.	Late Senior Research Assistant, Assistant Technologist, Technological Research Laboratory, Matunga, Bombay.

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RESEARCH STUDENTSHIPS—contd.

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Year of appointment.	Name.	Where posted on appointment	Branch of Cotton Research in which scholarship granted	How now employed.	REMARKS
1926	Ram Saran Koshal, M Sc (Punjab)	Technological Research Laboratory, Matunga, Bombay.	Textile Physics	Senior Research Assistant (Physics), Technological Research Laboratory, Matunga, Bombay	Indian Central Cotton Committee
"	M A Shama Iyengar, B Ag (Bombay).	Surat	Cotton Physiology	Sind Agricultural Department, Senior Assistant to Agricultural Chemist and Soil Physicist, Sakrand.	Awarded a Training Grant for foreign study in 1933
"	Karam Singh Lamba, B Sc, Lyallpur Honours School (Punjab)	Lyallpur	Cotton Entomology	...	Resigned in July 1927
"	V. D Wad, M.A., M Sc (Bombay), A I I Sc	Combatore	Cotton Bio-chemistry	Chemist and Agronomist, Institute of Plant Industry Indore	Indian Central Cotton Committee
"	H A Idnani, B Ag (Bombay)	Institute of Plant Industry, Indore	Cotton Botany	Sind Agricultural Department, Cotton Supervisor, Indus Right Bank, Sind	Do
"	S C Talesara, B Ag (Bombay)	Do	Do	Seed Distribution Scheme, Dadu Assistant Farm Superintendent, Institute of Plant Industry, Indore	Do
1927	R Lakshminarasimha Iyengar, B Sc (Mysore)	Technological Research Laboratory, Matunga, Bombay	Cotton Technology	Technological Assistant, Combatore	Do
"	Anant Krishna Thakur, M.Sc (Bombay)	Institute of Plant Industry, Indore	Bio-chemistry	Assistant Chemist, Indian Lac Research Association	....
"	Dev Raj Mehta, B Sc, Honours School (Punjab)	Lyallpur	Cotton Entomology		Secured Government Scholarship for study abroad and obtained Ph. D. (Cantab)

RESEARCH STUDENTSHIPS—*contd.*

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Year of appointment.	Name.	Where posted on appointment.	Branch of Cotton Research in which scholarship granted.	How now employed.	REMARKS.
1927	Uma Shankar, M.Sc. (Allahabad).	Cawnpore ..	Cotton Entomology.	Assist. Professor of Zoology and Entomology, Agricultural College, Cawnpore.	Obtained Doctorate at Edinburgh.
"	Shripad Shamrao Rane, M.Sc. (Benares Hindu University).	Institute of Plant Industry, Indore.	Cotton Physiology ..	Unemployed ..	....
"	Sant Singh Verma, M.Sc. (Benares Hindu University).	Dharwar ..	Cotton Physiology in connection with Cotton Wilt Investigation.	....	Awarded a Foreign Scholarship by the Indian Central Cotton Committee. Obtained Ph. D. (Lond.)
"	Lakshmi Narayan Mathur, M.Sc. (Punjab).	Institute of Plant Industry, Indore.	Cotton Breeding ..	Crop Botanist, Ujjain, Gwalior Department of Agriculture.	....
"	Kadaba Rangaswamy, M.Sc. (Calcutta).	Coimbatore ..	Do.	Unemployed ..	....
"	S. Shamser Singh, M.Sc. (Punjab).	Institute of Plant Industry, Indore.	Cotton Agronomy ..	Agricultural Officer, Bikaner State.	....
1928	K. Dharmarajulu, M.Sc. (Bombay).	Dharwar ..	Cotton Mycology ..	Assistant Botanist, Madras Pempheres and Physiological Scheme.	Indian Central Cotton Committee.
"	Piara Mohan, B.Sc., Honours School (Punjab), M.Sc.	Cawnpore ..	Cotton Entomology	Field Assistant, Parasite Work, Pink and Spotted Boll-worm Scheme, Punjab.	Do.
"	R. N. Gidwani, B.Ag. (Bombay).	Surat ..	Cotton Agronomy ..	Sind Agricultural Department. Inspector of Agriculture, Eastern Nar Circle, Mirpurkhas.	....
"	M. Kanti Raj, M.A., B.Sc. (Agri.) (University of Edin.)	Institute of Plant Industry, Indore.	Do.	Madras Agricultural Service.	....
"	C. Nanjundayya, M.Sc. (Calcutta).	Technical Research Laboratory, Matunga, Bombay.	Cotton Technology	Junior Research Assistant, Technological Research Laboratory, Matunga, Bombay.	Indian Central Cotton Committee.

# RESEARCH STUDENTSHIPS—contd

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Year of appointment	Name	Where posted on appointment	Branch of Cotton Research in which scholarship granted	How now employed	REMARKS
1929	Srinagabhushana B Sc	Technological Research Laboratory Matunga Bombay	Cotton Technology	Technological Assistant Surat	Indian Central Cotton Committee
3	Bhai Pratap Singh Bhullar B Sc (Agr) (Punjab)	Lyalpur	Cotton Marketing and Economics	Punjab Agricultural Department	
1930	Bhai Ajaib Singh Gulzar B Sc (Agr) (Punjab)	Do	Do	Do	
	Madan Lal Bhatia M Sc (Punjab)	Do	Entomology	Abroad for further study	
4	Bhola Nath M Sc (Punjab)	Institute of Plant Industry Indore	Cytology and Plant Breeding	Genetical Institute of Plant Industry Indore	Indian Central Cotton Committee
	Pran Nath Mehra M Sc (Punjab)	Sakrand	Do		Resigned
1931	Brajendra Nath Bhargava M A (Lucknow)	Lucknow	Cotton Marketing and Economics		Resigned
	B S Sheshgiri B Ag (Bombay)	Surat Gujarat	Do		
	K R Dube B Ag (Nagpur)	Nagpur	Do	Dist Supervisor Enquiry into the cost of production of Cotton and Sugar cane crops Central Provinces	
4	Santokh Singh Jaggi B Sc (Agr) (Punjab)	Lyalpur	Do	Agricultural Assistant Punjab Botanical Research Scheme Madras Agricultural Service	Indian Central Cotton Committee
1	Doraiswami Ayyar B A Madras	Madras	Do		
1935	Krishna Behari Lal M Sc (Cal) Ph D (Edinburgh)	Lyalpur	Cotton Entomology	Research Student	Under training
1	Sant Singh Verma M Sc (Benares Hindu University)	Foreign Research Studentships Imperial College of Science and Technology London			Completed training July 1935 Obtained Ph D of London University

RESEARCH STUDENTSHIPS—*could*.

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Year of appointment.	Name.	Where posted on appointment.	Branch of Cotton Research in which scholarship granted.	How now employed.	REMARKS.
1933	S. N. Venkatramanan, B.A., B.Sc. (Agri.) (Madras).	Calcutta	.. Cotton Statistics ..	Madras Agricultural Service	....
	C. Jagannatha Rao, B.A. (Madras).	....	Cotton Physiology	Research Student ..	Under training.
<i>Foreign Training Grants.</i>					
1933	M. Taskhir Ahmad, B.Sc. (Agri.) (Punjab).	Trinity College, Cambridge.	Entomology	Assistant Entomologist, Imperial Institute of Agricultural Research, Pusa.	....
"	G. B. Patel, B. Ag. (Bombay).	University of California, U.S.A.	Cotton Breeding	Research Student ..	Under training.
1934	M. A. Shama Iyengar, B.Ag. (Bombay).	Tour in Hungary, England and Egypt.	Study of Kalar (al-kali) lands and cultivation of superior Egyptian cottons with special reference to soil and environmental conditions.	Sind Agricultural Department. Senior Assistant to Agricultural Chemist and Soil Physicist.	....
"	Nazir Ahmad, M.Sc. (Punjab).	Imperial College of Science and Technology, London.	Entomology	Research Student ..	Under training.

" Indian Central Cotton Committee" in the remarks column indicates a post paid for from one of the Committee's Research Grants.

